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Trial Periods for Revised Rates

IN a number of recent public utility decisions, a trial period of one year has been named by the regulating commission as a proper time in which to observe the working out of the new schedule of rates approved. This has occurred in both the central-station and the electric-railway fields, and off-hand looks like a reasonable attempt to guard the interests of the utilities and the public alike. Unquestionably the cost of regulation and particularly the cost of investigating rate problems has influenced commissions in the direction of wishing to avoid recurring disturbances of the rate structure before a fair trial of the new charges for service can be had, and some regulating boards have clearly felt that in less than a year, a good idea cannot be gained of the equity of any particular set of rates.

Two questions arise in this connection. First, is it wise to fix a period during which a rate structure shall remain fixed; and second, if a probationary period, as it were, is desirable, should it have a stated length or minimum? A long study of commission work at pretty close range on the whole disinclines one to believe in a rigidly limited period of rate application. In many cases a year is certainly more than sufficient to disclose whether a utility can earn anything like a fair return upon its investment; in other cases, a longer time may be required. No matter how fair-minded a commission may be, modern regulation is still a new field of activity; and with the best intentions in the world it is possible for a rate-making board to misjudge a case for lack of the right kind of evidence. At best, the fixing of rates by an outside tribunal unacquainted with the intimate problems of management is bound to be something of an experiment, and the younger commissions of course have more to learn in this connection than some of the older ones. Again, no one can forsee the events even of a single year which may not, it is true, throw a company into a receivership, but which very clearly may wipe out its profits through no fault of its management, and in such emergency, relief ought not to be denied pending the passage of a fixed period of time. At least one may say that a commission should always reserve the right to reopen any case in which a previous decision is clearly seen to be working unfairly and toward a disastrous result, and if regulating statutes do not provide this flexibility, amendments may well be sought. A tentative period of stated length is one thing, and a refusal to re-open a case under any circumstances during that period is quite another.

If a tentative period is assigned, it may properly be long enough to enable the full effect of new rates to be analyzed, and while a year may be sufficient for this in many cases, one should not overlook the fact that 12 months is a very short time in the history of a growing utility. The cost of developing a company in accordance with an efficient economic policy should be duly considered, so that the mistake will not be made of assuming that because certain extraordinary expenses or capital outlays may be absent in one year, such expenses will not be necessary another twelvemonths. The great problem of obsolescence looms nearer on some properties than on others, and even a highly skilled management cannot foresee in many cases the impending changes in plant which may arise during a trial period of fixed length. Certainly there should be some allowance for the greater capitalization problems of the utility over a series of years in seeking to check the efficacy of a given rate structure in a specific time. Just as the indeterminate franchise has won favor in many quarters so a rate schedule established in process of regulation may well find in a non-rigid trial period its best opportunity for testing under average conditions, so far as they may be approximated. Those average conditions include a fair allowance for contingencies based on sound judgment in apprehending the future trend of utility development and problems. No sensible believer in regulation wants to re-open cases of complex character for any but serious and important reasons, but in establishing schedules of prices for utility service, it is a poor policy for any tribunal of the commission type to put an absolute time-lock on any particular docket.

The Free Exchange of Lamps

WHETHER a central-station company shall furnish its customers with incandescent lamps free of charge, or at cost price, or at a profit, depends to some extent on local conditions. Whichever practice is in vogue, it is usually the outgrowth of a traditional policy that is hard to break. As a matter of principle, however, the free exchange of lamps can scarcely be justified by any set of arguments or the employment of logic. Free incandescent units in exchange for burnt-out lamps are a heritage of the days when electric lighting was making its way against a type of illuminant that called for no further appliance than a match.

With the introduction of the Welsbach gas mantle,

a condition has come about that is perfectly analogous to the use of incandescent lamps in electric lighting, viz., an appliance is required, in either case, which demands renewing from time to time. We know of no gas company that supplies free mantles to its lighting customers, though there may be such.

Why, then, should electric lighting companies exceed their fellows of the gas industry in generosity? Is not our product sufficiently better to provide inducement for its use without the added gratuity of free lamps? We think it is fully able to compete on equal terms.

The gradual adoption of the heat-unit standard for gas, in place of the candlepower standard, throughout the country, emphasizes the growing dependence of gas for its illuminating efficiency on the incandescent mantle. Open-flame burners are bound to be eliminated altogether. The parity of the purchased lamp with the purchased mantle is evident, especially now that lamps have become so standardized that the customer no longer needs the protection against inferior lamps, which was true in the earlier days and which, no doubt, has led to the continuation of this policy for such a long time.

Engineers and Utility Valuation

AMONG the many court decisions affecting public utilities, there are two which have not only made necessary, but have also determined the policy of valuing public utility properties. One of these decisions was in the case of Munn vs. Illinois, 94 U. S. 113, in which the Supreme Court took the position that a business affected with a public interest is subject to public control, and the other was rendered in the case of Smythe vs. Ames, 169 U. S. 466, in which the court held that a company is entitled to a fair return on the fair value of the property.

In attempting to regulate and fix rates, public utility commissions were at once confronted with two problems: one was to determine what is property, and the other to determine the fair value of the property used and useful to the public. The ordinary meanings of the words property and value, meaning cost, give little indication of the difficulty of the problems. The legal meaning of the term property connotes much more than physical or material things possessed. Property is of two kinds, tangible and intangible. The machinery and other equipment of a public utility constitutes tangible property, while on the other hand such things as going value or good will constitute a large part of the intangible property. Furthermore, to determine the fair value of a property is in many instances more difficult than to decide upon what should be classed as property. The value of any property is a function of many variables, such as cost, time, place, use, and in some cases may even depend upon whim or fashion of a people.

The valuation of a public utility property thus involves accounting, engineering, economic, legal and psychological principles. To determine the fair value of a property when so many varying and variable factors are involved is evidently a problem which can at best be solved only approximately.

It would appear that as the plants and distribution systems of public utilities have been designed and constructed under the supervision of engineers, that these same engineers would be best qualified to determine the fair value of such properties. The truth must, however, be recognized that experience has not borne out this assumption. The cause of this discrepancy between assumption and experience undoubtedly is found in the fact that engineering principles play only a small part in valuation proceedings. An examination of the valuation reports in proceedings before public utility commissions discloses certain incontrovertible facts. The engineers making these reports may be well qualified, and usually are, to estimate the cost of construction of the tangible property of a public utility, nevertheless when they attempt to determine the fair value of such a property their results differ amazingly. Were two equally capable sets of engineers asked to estimate the cost of constructing a power plant to serve a certain community the final estimates would undoubtedly differ, but such difference as did exist would be due primarily to type of construction and machinery proposed. No such difference between the final estimates would be found as is entirely too common in the estimated values of public utilities already in operation. When the valuations of a public utility by two sets of engineers are in the ratio of 5.5 to 1 it reflects not only on the intelligence and integrity of the engineers concerned, but on the whole engineering profession.

It is difficult to understand why engineers who have been trained to respect facts, and who in their daily practice act on the precept that a mere opinion will not prevent the collapse of a bridge, and who would quickly question the fitness of a fellow engineer should he testify that good fire-room practice requires the burning of 15 pounds of coal per kilowatt-hour at the switchboard, should in valuation proceedings become advocates and testify in such a manner as to cause the public to question their honesty. This is especially unfortunate at this time as the general public has little appreciation of the function of true engineering.

The engineering profession has been slowly educating the public to an appreciation of the engineer's special fitness in helping solve many of the problems requiring expert knowledge. Nothing will more surely and quickly destroy this slowly awakening faith of the public than the partisan attitude of engineers in valuation proceedings. These are proceedings in which the public is keenly interested, and where it expects to find engineers exemplifying the highest ethical and engineering principles. If the public is disappointed in this, engineers may expect to find it very difficult to rehabilitate themselves in the good opinion of the people.

The engineering societies can perform a great service both to the public and to the engineering profession by adopting and promulgating some rules for the guidance of engineers in valuation proceedings.

HAPPENINGS IN THE INDUSTRY

Public Policy Committee of N. E. L. A. to Widen Scope of Work—Prof. Clewell Discusses Factory Lighting at Chicago Meeting—Electrification of Lehigh Valley Road Planned—Report of Mid-Winter Convention of American Institute—Celebration of Edison's Birthday—Great Northern to Electrify—Miscellaneous News Notes

PUBLIC POLICY COMMITTEE OF N. E. L. A. TO WIDEN SCOPE OF WORK.

Plans Provide for Compilation of Vast Amount of Valuable Data—January Meeting of Executive Committee Considers Convention Matters.

The Public Policy Committee of the National Electric Light Association, of which W. W. Freeman, of Cincinnati, is chairman, has virtually completed plans for the compilation of a considerable amount of important data and work will begin just as soon as the necessary funds have been secured. Among the questions considered are: (1) Compiling data on the rulings of commissions in the various states; (2) Valuation terminology; (3) Proper methods in determining valuation; (4) Compilation of rates and rate data; (5) Information as to municipal ownership and operation; (6) Information as to municipal ordinances and franchises; (7) Water-power regulation and legislation; (8) Regulations affecting inductive interference in transmission lines.

The January meeting of the Executive Committee of the Association, which was held on January 26 in New York, considered the usual routine business. Resolutions regarding the death of R. S. Orr, vice-president, were adopted. President Wagner announced the appointment of W. C. L. Eglin, of Philadelphia, as chairman of the Committee on Constitution and By-Laws, succeeding Mr. Orr, and Paul Spencer, of Philadelphia, chairman of the Committee on Relations with Other Associations, succeeding Mr. Orr.

Reports of the secretary, treasurer and Membership Committee chairman were presented. E. A. Edkins, of Chicago, chairman of the Commercial Section, reported that work was progressing rapidly on the preparation of reports and papers for the annual convention. A fund was authorized for the purpose of making tests in order to ascertain the feasibility of employing wires of different coverings when imbedded in plaster. Mr. Edkins also reported that the Section has under way an active campaign to induce furniture manufacturers to equip dining-room tables, dressers, beds, etc., for built-in lighting equipment and with outlets for cooking devices.

Chairman McClelland of the Technical Section, and Chairman Mansfield of the Electric Vehicle Committee also submitted reports.

As chairman of the sub-committee to report on the recommendations of the Company Section Committee, E. W. Lloyd, of Chicago, read the recommendations of the Section Committee covering the organization at headquarters of a bureau of correspondence and instruction, an associate membership with abridged privileges and dues considerably less than for Class B members, a new class of membership for employees desiring a larger participation in Association privileges than is afforded a Class B member—for example, entitling a member to a full set of *Proceedings*, copies of all handbooks, etc.—with dues of $10 or $15 a year, and the limitation of enrollment in the different educational courses to individual members of the Association. Mr. Lloyd reported that his committee felt that while the organization of a bureau of correspondence and instruction would be valuable, its cost prohibits its establishment at this time. The committee also felt that only employees of Class A and D companies should be eligible to enrollment in the educational courses at the existing rates, and that non-members wishing to enroll should pay an additional $5.00. The committee further recommended that no handbooks, or similar publications should be sold to non-members of the N. E. L. A. who were employees of member companies at a lower price than $5.00. The committee could not concur in the recommendation of the Company Section Committee that a $2.00 membership class be established, as this would result in a very considerable reduction in the revenue of the Association without a corresponding reduction in the cost of material now delivered to Class B members, but suggested that the general attitude of the Class B members toward the Association should have very serious consideration, and that a rearrangement of the monthly *Bulletin* and the inclusion of a bibliographical reference in the *Question Box* would prove beneficial. Mr. Lloyd's committee also felt that the recommendation for the formation of a more privileged class than the present Class B could be taken care of by members joining more than one section.

The adoption of the report was carried, but it was voted to continue the committee for further study of the situation.

IMPORTANCE OF GOOD FACTORY LIGHTING STRONGLY EMPHASIZED.

Illustrated Address Given in Chicago by Prof. C. E. Clewell, of the University of Pennsylvania.

The subject of factory lighting was the main topic of discussion at a meeting held in Chicago by the Chicago Section, Illuminating Engineering Society, on February 16. C. E. Clewell, of the University of Pennsylvania, was the principal speaker, and gave an illustrated address on various phases of the subject. Referring to a recent hearing before the Pennsylvania Public Service Commission, in which the attorney of one of the petitioners had suggested an inspection of the homes to find out whether the utility was giving the proper lighting service, Professor Clewell stated he would not be surprised to find that such inspection in homes and other places where lighting service is rendered would be undertaken in the future. Lighting inspection of factories is already making headway and it seems reasonable to assume that it will be extended to other lighting installations.

The problem of furnishing proper lighting for factories is very complex on account of the various elements that must be considered. These were discussed in detail by Professor Clewell, who then took up the two main aspects of factory lighting, first, from the humanitarian standpoint, second, from the economic standpoint of efficiency of workmen and maximum possible production. C. F. Scott in 1910 showed that to provide good lighting in a factory costs only as much as the wages for but a few minutes of the time of the employees. Poor lighting results in very heavy losses due to spoilage of work, slacking off when the light is unsatisfactory, and serious accidents from inability to avoid hazards. It has been quite conclusively shown that about 25 per cent of industrial accidents are due to poor lighting. It is very difficult to secure actual data on production economies resulting from good lighting; such data now available are very meager. There is no question but that good lighting does improve the production and the exact amount will depend upon the nature of the industry and the particular work being performed and upon many other conditions. Pro-

fessor Clewell said it is simply astounding to find differences something like nearly 1,000 per cent between the extremes of lighting found in different factory installations of the same kind.

The subject of factory lighting has been given attention only in recent years. Formerly there was a belief that in rooms or departments used only during daylight hours no consideration need be given to artificial lighting. However, even in such rooms a marked falling off in production occurs when partial darkness sets in during working hours, especially in the winter months. In the Westinghouse plants at East Pittsburgh about $125,000 was spent in a few years to improve the lighting of the shops; this did not include the cost of rearranging the circuits which was found necessary in many instances. This heavy expenditure was found to well repay itself in the better shop and production conditions attained.

It is quite common to find the same circuits used for lighting and power in factory installations; in many instances it is only about 10 per cent of the total energy that is used for lighting and therefore it is commonly held to be unnecessary to provide separate lighting circuits. However, the frequent starting of motors causes violent and objectionable voltage fluctuation and unless the lighting load is connected to a separate circuit very poor lighting service must result. These conditions are just as common in small as in large factories. The development in new lamps in recent years has been the chief feature in bringing about stimulation of interest in improved factory lighting and the salesmen of the lamp, fixture or accessory manufacturers have played a very important part in promoting this interest.

After reviewing the advantages of good factory lighting, Professor Clewell laid down the following as the requirements that such lighting must meet. First, there should be sufficient intensity of general illumination so as to prevent accidents and to permit getting around machinery and obstructions freely and without danger. Second, there must be sufficient intensity at the place of work, usually of a higher order than that just referred to. In many cases both the first and second requirements can be met by an abundantly high intensity of general illumination. Third, suitable shades and reflectors must be provided to shield the eye from glare or other strain and incidentally to direct the light into useful directions. Fourth, circuits must be provided of sufficient size to get the constancy of voltage that is required for satisfactory lighting. Fifth, protection must be provided against interruption of service. Both these last requirements necessitate that the lighting be carried on a separate set of circuits. Finally, the mounting height and size of lamps and reflectors should be determined by the height of the ceiling or other local conditions. In conclusion, Professor Clewell spoke of the code of factory lighting of the Illuminating Engineering Society and the state codes on the subject promulgated by the industrial commissions of Pennsylvania and New Jersey.

In the general discussion that followed there participated O. L. Johnson, J. Stair, A. L. Arenberg, Mr. Stuart, Prof. Clewell and a few others.

ELECTRIC OPERATION PLANNED FOR LEHIGH VALLEY RAILROAD.

Present Plans Involve Section of 176 Miles Between Jersey City, N. J., and Wilkes-Barre, Pa.

The Lehigh Valley Railroad is considering the electric operation of its main line between Jersey City and Wilkes-Barre, Pa., a distance of 176 miles, including the Mahanoy and Hazelton division, from Penn Haven Junction to Mount Carmel, about 52 miles. The engineering department is making extensive investigations of the practicability of the proposed plan, which covers the electric operation of all important service throughout this territory of 228 miles and involves a project of unusual magnitude. In the Pennsylvania district the road passes through very rugged territory, particularly between Easton and Wilkes-Barre, 99 miles, with exceptionally heavy grades in the vicinity of Mauch Chunk; the Mahanoy and Hazelton division tops a mountainous district that has necessitated many instances of difficult track construction between mountain and valley sections.

In connection with this undertaking it is planned to employ the electric power stations operated by the Lehigh Coal & Navigation Company at Hauto and Harwood, with present generating capacities of 30,000 kilowatts and 16,250 kilowatts, respectively. Additional plants will be established at convenient points with necessary transmission and distributing lines. The cost of the improvement is estimated at $15,000,000.

MEETINGS OF ASSOCIATED MANUFACTURERS OF ELECTRICAL SUPPLIES.

Board of Governors Met on February 21—Section Meetings to Be Held March 13 and 14—Annual Banquet March 15.

The Board of Governors of the Associated Manufacturers of Electrical Supplies held its regular meeting, February 21, 1917, at the offices of the association, No. 62 Cedar Street, New York City.

The regular meetings of all Sections of the Associated Manufacturers of Electrical Supplies, scheduled to take place in February, have been postponed to the week commencing March 12, 1917, this change being made to meet the convenience of out-of-town members desiring to attend the annual meeting and banquet of the Association, which will be held on March 15, 1917, making it possible to attend the Section meetings in which they are interested, together with the annual meeting on one trip to New York.

The annual meeting of the Associated Manufacturers of Electrical Supplies will be held on March 15, 1917, at Delmonico's, Fifth Avenue and Forty-fourth Street, New York City. The Association has made remarkable progress during the past year, and it is anticipated that the annul meeting will be largely attended, and will be an interesting and enthusiastic one.

The meeting will be followed by a banquet, the evening of Thursday, March 15, to be held in the Grand Ball Room of Delmonico's. Charles E. Dustin is general secretary of the Association.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS HOLDS IMPORTANT MIDWINTER CONVENTION.

Technical and Practical Electrical Engineering Problems Discussed in Well Attended Convention.

The fifth midwinter convention of the American Institute of Electrical Engineers was held at the Engineering Societies Building, New York City, February 14 to 16.

President H. W. Buck called the convention to order on Wednesday morning, and in the course of his opening address said:

President Buck on Engineering Co-operation for National Defense.

"Engineers have shown a keen appreciation of the relations of engineering to science by employing pure scientists in engineering organizations. The development of the research laboratory in our large electrical manufacturing and other concerns has been one of the most significant steps in the progress of modern engineering. Not only has this spirit of co-operation between pure science and engineering made itself felt through this public service, but a spirit of co-operation between engineers has taken place and grown more than in any other period in the history of our engineering societies. Engineering societies have cast aside that insular feeling they have had and shown a

recognition of the fact that all branches of engineering are interrelated by the movement recently started of bringing together all of the activities of all of the engineering societies in this country by the proposed development of the organization probably to be known as the Engineering Council of the United Engineering Societies.

"There is also another form of engineering co-operation which has come before us in the last few weeks, and that is the co-operation between the engineers and our government. That is the most urgent proposition for co-operation which I think has ever come before the engineers of this country. The government looks to us for assistance, and we look to our government, our army and our navy, for instruction and guidance, and we must do everything in our power to bring the engineers of this country together so that they can work as an effective force in case an emergency arises, and the crisis before this country at the present time develops into war. There is not an engineer in our organization who is not perfectly willing to go to the front, if necessary; at the same time it is a question whether that is the most effective way to use the talents and abilities of the engineers for assisting this country. Engineers have a very important part to play and we want to make sure that the engineers play it in the most effective way."

Dr. C. R. Mann, of the Carnegie Foundation for the Promotion of Teaching, then addressed the meeting and outlined the work which the Joint Committee on Engineering Education is doing, the committee being composed of representatives of the various engineering societies. He spoke of the very comprehensive work which the committee has done in formulating plans for the efficient education of the engineer, in view of the modern developments of industry, and stated that the report of the committee would be ready at an early date.

Internal Temperatures of Generators.

The paper on "Internal Temperatures of Alternating-Current Generators," by Ralph Kelly, was then read by Prof. A. M. Gray. Mr. Kelly's paper deals with the internal temperatures of a number of typical large alternating-current generators, this temperature being measured by a thermocouple placed between armature coils in the same slot and in the center of the core. The difference between these measured internal temperatures and the corresponding surface temperatures in the tests given varies from 0 to 35.5 degrees centigrade. This wide divergence is explained by the aid of the tests and of calculations. A method of calculation for internal temperatures is given which is based on simple heat laws and on data obtained from many tests. By means of the tests and of parallel calculations, the effect on the internal temperature of changes in frequency, core length, thickness and quality of insulation, armature current density and core densities, is explained. The capacity of the end windings to dissipate heat from the center of the core is also discussed. In conclusion, it is stated that although the wide divergence between surface and internal temperatures of different classes of generators is regular and can be justified, yet it is plain that there is no one average figure that can be used for that difference for all classes of alternating-current generators.

In the discussion H. G. Reist said that the paper showed very clearly the method of analysis for the location of losses in large generators that has become necessary to produce the generators now being built to be driven from steam turbines. In these machines the losses are very great and as the author points out the distances to the ends of the core and to the back of the core are so large that very little heat can be taken off from those parts and the heat must be dissipated very close to the point where it is generated. This is usually done by having radial conductors, or by having axial conductors, but in the case of the latter they must be placed very close to the coils, because the heat generated in the teeth and in the slots is very much greater than in other parts of the machine, and the heat cannot be conducted to the back of the core on account of the large temperature drop in the iron.

C. A. Adams remarked that it took a good deal of education to make practical operating engineers believe there was any such difference of temperature between the hot spot in the insulation, which is discussed in the paper, and the surface or measurable temperature by thermometer. The ability to predict in a new type of machine, a machine of new proportions in many ways, even approximately what the hot-spot difference is going to be, is of the greatest possible importance. There is no problem in the designing of electrical machinery which is more important than the thermal problem and there is also no problem that is more complicated or more difficult to handle.

W. F. Dawson pointed out it was very remarkable that the results shown in the paper corresponded so closely with the knowledge had on the subject. Some armature conductors are practically free from Foucault and other parasitic losses, while others are almost solid bars, much too large for the machines where they are used, and the parasitic losses are enormous. In many cases these losses could have been foreseen and exposed by an intelligent use of the temperature coils and the thermal drop indicated.

H. M. Hobart called attention to the undesirability of pinning too much faith to internal-temperature detectors. These were welcomed a few years ago, but he thought there was a danger of taking the results obtained by such temperature indicators as being too much superior to other methods of ascertaining the temperature.

There was further discussion by C. A. Adams and W. F. Dawson. Prof. Gray closed the discussion on the paper.

Reactors and Protection of Central-Station Circuits.

At the Wednesday afternoon session, at which C. A. Adams presided, three papers were presented in a group as follows: "Reactors in Hydroelectric Stations," by J. Allen Johnson, and "The Effect of Current-Limiting Reactors in Steam-Turbine Stations Under Short-Circuit Conditions," by Paul B. Juhnke, read by the authors, and "Protection of Transformer Neutrals Against Destructive Transient Disturbances," by Max H. Collbohm, read by J. B. Taylor.

Mr. Johnson's paper states that the advantages and limitations in the use of current-limiting reactors in hydroelectric stations are not so well recognized or understood as they are in steam-turbine stations, but it is now coming to be realized that their use may be quite as justifiable and necessary in the former as in the latter. The two beneficial results of reactance, protection and localization, are distinct, the former being associated with the square, and the latter with the first power of the reactance. Of two detrimental results of reactance or limitations to its use, that of voltage drop is well understood, but the other, the reduction of synchronous stability is not so well understood. The installation of reactance usually results in a decrease in the stability of synchronism. Practically, complete instability or asynchronism occurs in a large station when the phase angle exceeds 90 degrees. The asynchronizing effect of a sudden load change is approximately twice that of a gradual change of the same magnitude. The origination of a power surge by sudden loss of load and the accompanying hunting oscillation is described. Increased reactance increases the amplitude of both the power

surge and the phase-angle oscillation and also increases the period. A certain amount of reactance will result in complete asynchronism immediately following the load disturbance, and a smaller amount may cause troublesome and persistent hunting by forced harmonic oscillation of the turbine governors in combination with certain hydraulic conditions, such as long penstocks. It is shown that these phenomena form a practical limitation to the use of reactance, in that the reactances necessary to create the conditions described are of the same magnitude as those often indicated for protective and localizing purposes. The actual occurrence of a surge is described.

Mr. Juhnke's paper describes and comments on a cable breakdown near the Quarry Street generating station of the Commonwealth Edison Company's system. The breakdown resulted in a second breakdown on the same line within the station, which prevented the oil switch from automatically disconnecting the fault. The system is amply protected by reactors for generators and between bus sections. Their effect on the stability of synchronous apparatus on sections protected by them is very marked. The protection to the generating station apparatus was complete. Comparison of maximum stresses encountered in the short-circuit as it occurred with what they might have been without reactors present are made, and the conclusion is drawn that without them the damage resulting would have been considerable and the service interruption far more general and serious.

Mr. Collbohm's paper points out the danger to which the neutral point of transformers, connected to long-distance transmission lines, are exposed through the building up of excessive potentials at this point under conditions of atmospheric lightning. This is due to the fact that the neutral point in a bank of Y-connected transformers acts as a reflection point for all the waves that are produced by induced lightning, which waves, at the place of origin, have the same amplitude and sign, and therefore travel with equal speed, considering that the impedance of line and transformer is the same for each phase. The three waves meeting at the neutral point build up to three times their individual potential at that place, thereby producing excessive potential stresses, and according to experience destruction of bushings and windings. The author recommends the installation of lightning arresters at the neutral point to provide a discharge path for the excess potential, which according to measurement with a spark gap may reach values of 350,000 volts and higher.

F. H. Kierstead stated that Mr. Johnson had brought out the ill effects of parallel operation with the reactors between generators and Mr. Juhnke had shown the advantage of having reactors between the groups of generators. It seemed that, if reactors are not placed between the groups of generators, then with a fault anywhere all the generators are going to fall out of step any way, so it does not make very much difference even if they fall out of step, due to the fact that they do not synchronize together. In figuring the value of reactors necessary for the circuit a value should be chosen sufficient to protect the generators and let the falling out of step take care of itself.

Harry R. Woodrow thought that there was one question in connection with the bus reactance coil which had caused some misunderstanding, and that is the rating of these coils. He did not believe there was any standard form of rating in per cent bus reactance coils, and while each condition has to be studied in itself the rating is very important, that is, whether the per cent bus reactance is based on the full-load equipment of one generator or the full-load current of the bus section.

A. R. Cheyney stated that with growing loads and also from hour to hour with the load of every station changing very considerably, it is extremely difficult to lay out any scheme of reactors which are to be kept constantly in circuit which will be equally effective at all times, and the case considered in the paper by Mr. Juhnke is an instance where practically on peak-load conditions, both as to the yearly load and the time of the day, the protection was most urgently needed. Some form of reactance must be provided that can vary with the load. The present instance would seem almost conclusive evidence as to the necessity for installing reactance in the busbar, if the centering of the whole station generating capacity at any point along the busbars or connections is to be prevented.

Louis F. Blume said that Mr. Collbohm's paper was of much interest to him because the phenomenon represented in the paper is quite unusual. Breakdowns through high-voltage windings to ground in transformers insulated in accordance with the Institute specifications have been rare. Experience shows that insulation is quite conservative and ought to be sufficient in most cases.

There was further discussion by W. R. Bullard, John B. Taylor, R. F. Schuchardt and H. R. Summerhayes, after which there was the usual closure by the authors.

Corona in Hydrogen and Air.

At the Thursday morning session F. W. Peek, Jr., presided. The paper on "Corona and Rectification in Hydrogen," by J. W. Davis and C. S. Breese, was read by C. L. Fortescue, and the paper on "The Electric Strength of Air—VII," by J. B. Whitehead and W. S. Brown, was read by Professor Whitehead.

The results of an investigation of the corona discharge between coaxial cylinders in an atmosphere of hydrogen are given in the paper by Messrs. Davis and Breese. Both direct and alternating electromotive forces were used. The characteristic behavior of the corona is given by means of curves, photographs and oscillograms. The corona discharge in hydrogen was found to differ from that in air in the following particulars: The discharge from a negative wire was found to differ widely from a positive wire in the magnitude of the voltage necessary to start the discharge, in the shape of the volt-ampere characteristic and also in the stability of the discharge. Corona in hydrogen between concentric cylinders is shown to be a practicable method for rectifying high-potential alternating currents. The apparent evidence of ionization potential gradients at the surface of the tube and the general character of the visual phenomena are also discussed.

In view of the variation among the values obtained by different observers, the paper by Messrs. Whitehead and Brown aims to make a careful determination of corona-forming voltages for alternating and for positive and negative continuous voltages in the same apparatus and under the same conditions. Within the range of wire diameters used, corona appears at a lower value when the wire is positive than when it is negative, although the two curves converge for increasing diameters. The maximum excess of negative over positive, as observed, was 6.3 per cent. The values with alternating voltage coincide with those of negative continuous voltage. Positive continuous voltage therefore forms corona at the lowest value. The observations on the negative corona give values higher than any heretofore obtained. Other experiments are described, giving qualitative indications of the correctness of Townsend's theory of ionization by collision.

In the discussion S. Dushman said that the problem of obtaining high-voltage direct current for use in such experiments as described in the paper by Davis and Breese is of great importance. One method is to use a series of direct-current generators, such as described in the paper, and another method, which is very convenient, consists in the use of a transformer and some type of rectifier.

J. B. Taylor said he could not understand why a negative corona has a different action from a positive corona, which it does obviously have in hydrogen, but to a less extent than in the case of air.

L. W. Chubb called attention to the important step forward indicated in the papers, but it covers only a part of the problem.

Chairman Peek stated that the tests of Davis and Breese indicated that hydrogen as a gas followed the same law as air in corona formation by electric strength. However, the conceptions were apparently different. He found it extremely difficult in direct-current corona to determine exactly which way the negative point started. The positive was quite defined and apparently about the same as with alternating current.

John B. Whitehead stated that in presenting papers of the class of Davis and Breese the actual observations and methods by which the conclusions are reached should be stated. There were no readings of pressure, nor are the temperatures in the tube given, and that it was extremely probable in this case that hydrogen does not obey the law.

Oscillating-Current Circuits.

The paper on "Oscillating-Current Circuits by the Method of Generalized Angular Velocities," by V. Bush, was then read by the author. This paper showed that the oscillating-current circuit differs from the alternating-current circuit in that the sinusoids involved are damped. In the same way that alternating-current theorems are obtained by generalizing direct-current theorems, it is possible to obtain oscillating-current theorems by still further generalization. This involves a generalized angular velocity and a generalized impedance which are complex quantities. Kirchoff's law may be thus generalized, and yields a simple method of determining the generalized angular velocities, and thus the frequencies and decrements of free oscillation. A simple example is given to show the method of procedure. The discharge of a leaky condenser through a reactor furnishes a second example which better illustrates the convenience of the method for numerical computations. As a third example the oscillation of a three-section artificial cable under particular terminal conditions is chosen.

A. E. Kennelly considered the paper by Mr. Bush of much interest theoretically, and practically it points out a simple method of making oscillating-current circuits as easily managed by engineers as the alternating-current circuits, the only essential difference being that the coefficient by which the capacitance of the circuit is multiplied, instead of being a pure mathematical quantity, is a complex quantity, which contains a real component. The important and new material which is presented in the paper is the parallel impedance.

C. L. Fortescue thought there was much importance in the method of starting the three oscillations of the network. There was also discussion by Thorton C. Fry, after which the author closed.

In the evening Capt. J. H. Cuntz, of the Signal Reserve Corps, and Major J. H. Finney, of the Engineer Reserve Corps, delivered addresses on the subject of national preparedness, and the part which engineers could take therein.

This was followed by the lecture on "Modern Physics," by R. A. Millikan, president of the American Physical Society, and professor of physics, University of Chicago.

Direct-Current Motor Control Problems.

At the Friday morning session J. Franklin Stevens acted as chairman. The papers on "Industrial Controllers With Particular Reference to the Control of Direct-Current Motors," by H. D. James, and an "Analysis of Starting Characteristics of Motors," by K. L. Hansen, were both presented by Mr. James.

Mr. James' paper states that present-day development of motors and controllers is such that former limitations as to regulation of starting current from the viewpoint of motor, controller and supply system have been largely removed. The author presents a series of tests on 15 and 20-horsepower, 230-volt, direct-current shunt motors, started from rest. The motors are of two types, constant and adjustable speed. These tests were made to determine: First, the load driven by the motor; second, the power supply; third, the motor operation. From these tests the author concludes, in part, that it is practical with automatic acceleration to use one switch to short-circuit the armature resistor used with motors as large as 15 horsepower; that the shunt field of small adjustable-speed motors can be reduced in one step under normal load conditions (this practice can be safely followed up to motors of 50 horsepower); and that adjustable-speed motors can use one step resistance for dynamic braking.

In Mr. Hansen's paper are derived the mathematical expressions for the current, speed, torque and power at any time during the accelerating period when a shunt, series or compound motor is connected to a supply line.

In the discussion of these two papers R. E. Hellmund stated that in starting a series motor, for instance, from standstill with small resistance in its circuit, the field follows the current increase quickly and induces by transformer action high voltages in the coils under the brushes and all coils near the neutral, so that very severe spitting and flashing part of the way around the commutator may be obtained. With shunt or compound motors, the starting from zero speed is usually less difficult because the shunt field prevents, on account of its damping effect, sudden changes of the main field. These motors, especially shunt motors, are, however, very much subject to flashing if they are suddenly thrown on the line while they are still rotating.

J. H. Albrecht stated that he had proved most of Mr. James' contentions as to methods of operation in a munitions plant of which he had charge.

E. J. Murphy thought that there was no necessity for a large number of steps, but was not able to say that Mr. James' conclusion as to starting motors with one step is entirely satisfactory even with motors up to 15 horsepower.

E. H. Martindale was of the opinion that the proposals of Mr. James were a little too severe in having but one step in the resistance. There were theoretical objections to applying a single-step controller, but there was testimony of a plant that had been running with a number of motors with very severe conditions with that kind of control and the motors had given satisfactory service. Industrial motor application is probably the biggest field of electrical engineering.

Mr. Martindale further stated that the Industrial and Domestic Power Committee was this year trying to start some work looking toward a tabulation of the best type of motor and the best type of controller for every motor for every machine for every industry in the country, for both direct-current and alternating-current motors.

J. B. Fisken believed that the theoretical discussions would have to be considered in the light of the operating man who is under the direction of the modern invention known as a public service commission.

F. W. Gay stated that he had installed a single-knife switch for starting all motors under 15 horsepower in a plant in operation seven days a week, 24 hours a day, and at the end of 10 months' operation the motors were in good condition.

Alexander M. Gray referred to the fact that for 20 years

it had been the practice to start up induction motors on one step—some times two or three steps had been used—but now the operation more generally is with one step.

Carl G. Malott thought that because there had been so many steps in the past was the reason that the motors would not commutate under very severe conditions.

P. L. Goetzenberger said there are several factors affecting the starting characteristics of direct-current motors, which although frequently of minor importance, nevertheless, might create under certain conditions of design and operation more or less trouble.

R. G. Widdows said in closing a circuit through a motor maximum current will not be reached instantly, due to the inductance of the motor winding, and if the motor speed is increasing at the same time that the current is rising the maximum current peak will be lower than if the motor was stalled; also, if the motor is accelerating rapidly, the peaks of current caused by short-circuiting the starting resistance will be less than if the motor is accelerating slowly.

The papers were also discussed by C. T. Evans and Mr. James made the closure.

Alternating-Current Induction Motor Control.

At the Friday afternoon session E. H. Martindale presided. The papers on "Transient Conditions in Asynchronous Induction Machines and Their Relation to Control," by R. E. Hellmund, and "Performance of Polyphase Induction Motor Under Unbalanced Secondary Conditions," by A. A. Gazda, were both read by their authors.

Mr. Hellmund's paper discusses a number of transient conditions existing in asynchronous machines immediately after certain changes in the circuit connections are made. The advisability of considering these conditions in connection with the control layout for the purpose of eliminating bad effects caused thereby, is pointed out. The principal subjects considered are undesirable peak currents, which may be caused by the damping effect of the short-circuited rotor windings and the over-voltages, which are obtained with certain control arrangements.

In Mr. Gazda's paper continuous operation of the wound-rotor induction motor, when the external resistances in the secondary phases are not equal, is shown to be feasible. The effect upon power-factor and heating is discussed. Curves showing the performance of polyphase motors with single-phase secondary are presented. The practical advantages of using unbalanced secondary connections are pointed out.

R. B. Williamson remarked in connection with the pulsation of the current in the primary, as regards the operation of lights on the same circuit with the motor, he had in mind a case where a motor with an unbalanced speed-regulating resistance was employed, and while this pulsation would not be very great, it was enough to affect the

Edison Employees Honor Inventor on Seventieth Birthday

Several thousand of the employees of Thomas A. Edison united in giving the famous inventor a testimonial banquet on Saturday evening, February 10, in honor of his seventieth birthday anniversary which fell on the next day. An entire floor of the vast Edison Storage Battery Building at Orange, N. J., was cleared for the affair and it was taxed to its utmost capacity to accommodate the throng that gathered to honor Mr. Edison. Among the guests were many men prominent in the electrical world who have been closely associated with Mr. Edison at one time or another in his career. Among the personal friends of the inventor who were present was Henry Ford, the famous automobile manufacturer of Detroit. The birthday cake shown was sent with the compliments of the New York Edison Company. It is 40 inches in diameter with a height of 40 inches. It has on it 70 miniature electric candles, lighted from Edison storage batteries. The suggestion for the cake originated with Arthur Williams, of The New York Edison Company. Mr. and Mrs. Edison, Charles Edison and Henry Ford are shown in the photograph.

lights and might probably require a change to a balanced type of resistance.

Campbell Macmillan discussed the case of polyphase motors with single-phase secondary resistance and gave the conditions under which stability can be obtained. Data were given on the comparative results of operating with a three-phase and single-phase rotor.

H. Maxwell, in discussing Mr. Gazda's paper, referred to some oscillograms of induced voltage taken some years ago on a 10-pole, 60-cycle, 75-horsepower motor of standard design; he found it to be an alternating wave of approximately double line frequency with a very sharp peak in one direction, reaching a maximum value of several times the normal standstill open-circuit voltages of the rotor.

R. E. Hellmund, in commenting on Mr. Gazda's paper, said that the curves for the usual range of unbalanced resistances show that the increase of current over the average is not appreciable and that the increased losses in most cases are very small.

A. A. Gazda referring to Mr. Hellmund's paper, remarked that on account of the numerous variables involved it is practically out of the question to get the worst cases by means of oscillograms. There was further discussion by A. E. Averett, Arthur Simon, H. D. James and Charles F. Scott.

Thursday afternoon many of the members and guests attending the convention made inspection trips to the principle electric power houses in and near New York City and to other places of electrical interest. After the lecture by Professor Millikan on Wednesday evening there was a reception and on Friday evening a dinner-dance was held at the Hotel Astor.

MASSACHUSETTS CENTRAL STATIONS SHOW LOWER COSTS.

Use of Turbines Shows Marked Effect in Lowering Cost per Kilowatt-Hour.

An interesting study of increased manufacturing economies resulting from new turbine installation is contained in a comparison of itemized manufacturing costs of several Massachusetts central stations for the years ending June 30, 1916, as compared with that ending June 30, 1915, as contained in the annual reports of the Massachusetts Gas and Electric Light Commission for the two years. The figures show that owing to larger and more efficient units, generating costs, and especially the items of station wages and fuel, are less by 10 to 40 per cent than before the new turbines were put in. While it is to be noted that the figures covering the two years are not strictly to be contrasted, in that the period of new turbine operation fell short of or overlapped the year of record, the figures are sufficiently significant to show with a fair degree of clearness that lower costs were obtained.

During the year 1915 the Lynn (Mass.) Gas & Electric Company added one 4,000-kilowatt turbogenerator to its steam plant, which still retains in service 3,700 horsepower of steam engines.

The Brockton Edison Company added a 5,000-kilowatt horizontal turbine and two 600-horsepower boilers in 1914. This company also operates two 2,000-kilowatt vertical turbines at its East Bridgewater station.

The Salem Electric Lighting Company operates 8,750 kilowatts in turbines, of which a 6,250-kilowatt unit was installed early in 1916. It had already a 2,500-kilowatt turbine and 3,035 horsepower in engines. Both the turbine units are equipped with Le Blanc condensers.

The New Bedford company has had in operation 9,000 kilowatts in turbines, of which two of 2,000 kilowatts each were put in in 1912. This company has no steam engines. The generating plant is now being greatly extended, as are also the Worcester and Springfield stations. Turbines of large capacity will be installed by each of these companies in the near future.

Following are comparative figures of manufacturing costs, per kilowatt-hour made, in cents.

Company.	Total Mfg. Cost, 1914-15	Total, 1915-16	Fuel Cost, 1914-15	Fuel, 1915-16	Sta. Wages, 1914-15	Sta. Wages, 1915-16
Lynn	0.922	0.811	0.461	0.470	0.194	0.198
Salem	0.903	0.690	0.550	0.465	0.233	0.127
Brockton	0.852	0.790	0.458	0.489	0.179	0.138
New Bedford	0.890	0.746	0.472	0.576	0.309	0.162

GREAT NORTHERN TO ELECTRIFY WESTERN LINES.

Initial Project to Include 500 Miles at Cost of $20,000,000 —Hydroelectric Plant to Be Constructed to Supply Energy.

Marking the beginning of a plan for the electrification of all its rail lines in the Pacific northwest, at a cost estimated to be $20,000,000, announcement has been made by officials of the Great Northern Railway Company, Seattle, Wash., that the Chelan River hydroelectric plant would be started at once. The plant is to produce 150,000 horsepower to operate the company's lines from Spokane to Seattle. The plan also is to electrify the coast lines of the Great Northern between Vancouver, B. C., and Portland, Ore., a distance of 500 miles.

The work of building a dam and power station, the former at the foot of Lake Chelan and the latter on the Chelan River, which has a drop of 400 feet from the lake to the Columbia River, will begin this spring. The power plants will be built in the basalt side hills in the canyon of the Columbia River. This location for a power plant is said to be ideal. The construction of pole lines and other transmission equipment necessary for the complete electrification of the system west of the Idaho state line has already been started.

Important Meeting of New York Companies' Section.

The New York Companies' Section of the National Electric Light Association held a rousing meeting at the New York Edison Auditorium on Wednesday evening, February 21. Walter Neumuller, chairman, presided.

Joseph C. Forsyth, chief inspector of the New York Board of Fire Underwriters, was the principal speaker, his subject being "Electricity and the Reduced Fire Hazard." Mr. Forsyth was introduced by A. A. Pope.

John W. Roberts, noted war correspondent, recently returned from Mexico, gave a thrilling account of his personal experiences during three years' association with Villa in Mexico.

It was reported at the meeting that the membership campaign being conducted by the Section was making rapid progress, more than 150 new members having been secured during the past four weeks.

Conference of Plug Manufacturers to Consider Standardization Called.

The Wiring Committee of the Commercial Section, National Electric Light Association, which is considering the standardization of the connection of the cord to the lamp socket or wall receptacle and also the connection of the cord to the device, for all appliances which are arranged for connection to the ordinary electric branch circuit, has invited interested manufacturers to meet with the committee at National Electric Light headquarters, 29 West 39th Street, New York, N. Y., at 10:30 a. m. on March 15.

It is stated that this meeting will take no definite action except possibly to appoint subcommittees to discuss details more conveniently than at a large meeting. It is also stated that the meeting will not discuss prices or licenses. R. S. Hale, chairman of the Wiring Committee, will preside.

Miscellaneous NEWS NOTES

New Officers for American Institute of Consulting Engineers.—At the council meeting of the American Institute of Consulting Engineers, held in New York on February 6, officers were elected as follows: President, George Gibbs; vice-president, Lewis B. Stillwell; secretary and treasurer, F. A. Molitor. New members of the council elected were as follows: A. M. Hunt, Lewis B. Stillwell, William J. Wilgus and Gardner S. Williams.

To Illuminate Suburban Grade Crossings.—Following a disastrous grade crossing accident in Louisville, Ky., in which four persons were killed and many others injured, when a freight engine struck a heavily loaded street car, a demand has been made on the Board of Public Works of the city to provide for illumination of all such crossings. This would mean a largely increased number of street lights.

Mercury Bennett Addresses Texas League.—Ell C. Bennett, Mercury of the Jovian Order, St. Louis, Mo., was the principal speaker at the meeting of the Dallas (Tex.) Electric Club and Jovian League, on February 19. Mr. Bennett spoke of the great opportunities for the Jovian Order under the new constitution, and urged the co-operation of all leagues. C. W. Hobson, Potential No. 1, presided at the meeting.

Stringent Franchise Regulations in Panama.—The Government of Panama has decreed that only the executive may grant concessions for the use of land and water for the production and distribution of electric light and power. The law as published in the *Gaceta Oficial* stipulates that concessionaires, in return for specified exemptions, must agree to grant the Government a part of their gross proceeds from electric service, and to furnish electricity for public purposes at a reduction of not less than 25 per cent from the rates charged private consumers. Companies installing electric light in a city of at least 45,000 inhabitants must transmit their current underground. Contracts executed by the executive in conformity with this law will not require legislative approval before becoming effective.

Hardware Dealers See Opportunity in Electrical Appliances.—In addressing the 400 members of the Kentucky Retail Hardware and Stove Dealers' Association present at the convention in Louisville, recently, S. O. Sackstedter urged the hardware merchant to enter the electrical field and grow up in what he predicted was going to be an ever increasing business. "Our business souls need to be saved, and we should do it electrically. Don't let the other fellow get all the plums. Get in the game—order a supply of electrical appliances and learn to do the work yourselves. You have your buildings and your warehouses; you have established a reputation in your territory—go after this business before it is too late, and before the other fellow has established a store and beat you to it."

Bill to Permit Extension to Rhode Island Plant Discussed.—A hearing was held February 14 by the Rhode Island Legislative Committee on Corporations on a bill to amend the charter of the Rhode Island Power Transmission Company, an allied corporation of the New England Power Company, so that the former may exercise rights of eminent domain with respect to extending its lines. The company desires to construct transmission lines about Providence in the direction of Bristol and Warren, R. I., and Fall River, Mass. An amendment has been added to the bill which limits the company's right in Providence. At the hearing M. G. Chace, president of the company, said the purpose of the bill is to enable the Narrangansett Electric Lighting Company and the Blackstone Valley Gas & Electric Company to secure a cheaper and better electricity supply.

Washington Section of National Electric Light Association Formed. — A Washington section of the National Electric Light Association was formed by employees of the Potomac Electric Power Company. More than 100 members of the Potomac company became members of the organization. John C. McLaughlin was elected chairman of the new section; J. H. Ferry, vice-chairman; H. A. Brooks, secretary, and E. W. Whitehead, treasurer.

Interesting Meetings Planned by Louisville Jovians.—The Louisville Jovian League, under the direction of the new administration, headed by F. V. Gantt, is planning an interesting season's activities. Two meetings each month will be held hereafter, one at noon and the other in the evening. This plan is proposed, in order that those members who are not able to attend sessions in the middle of the day can arrange to be present in the evening. The March evening meeting is to be in the nature of a dinner-dance.

Coming Meetings of the American Institute of Electrical Engineers.—The March meeting of the American Institute of Electrical Engineers will be held at the Hotel Sherman, Chicago, Ill., on March 9. Two papers will be presented on the subject of relay practice; one of these papers will be presented by Philip Torchio and the other by R. F. Schuchardt. The April meeting of the Institute will be held in Schenectady, N. Y., on April 13. The program for this meeting has not yet been definitely completed. The annual business meeting of the Institute will be held in the Engineering Societies' Building, New York City, on May 18. At this meeting will be presented the annual report of the Board of Directors and announcement will be made of the election of officers for the ensuing year. It has been decided to hold the annual convention at the Homestead Hotel, Hot Springs, Va., from June 26 to 29.

Meeting of Ohio Central-Station Operators.—The mid-year meeting of the Station Operating Committee of the Ohio Electric Association was held on February 14, at Youngstown, O., in the Ohio Hotel, with a good attendance of operating men from all over the state. Three papers were read during the morning session, as follows: "Selecting, Educating and Handling Power-House Labor," by H. W. Bromley, of Youngstown, the paper being read by the chairman, on account of Mr. Bromley's illness; "Safety First in the Power Plant," by Herman George, Youngstown; "Effect of Steel-Mill Operating on the Method of Operating Stations," by Philip H. Marble, Youngstown. The afternoon was devoted to a trip of inspection, during which several plants were visited, including the Lowellville station of the Mahoning & Shenango Railway & Light Company, and the mills of the city.

Merger of Electric Light and Traction Properties, Reading, Pa.—The Eastern Power & Light Corporation, Reading, Pa., operating properties in Berks, Montgomery, Lebanon and Philadelphia Counties, covering electric light and power plants and urban and interurban traction systems, is arranging a further unification of its different subsidiaries. The proposed merger includes the following, subject to the approval of the Public Service Commission: Controlling interest in the United Traction Company, operating the Reading street railways, to be purchased by the Reading Transit & Light Company; purchase of the Edison Illuminating Company and the Lebanon Valley Electric Company, both of Lebanon, Pa., by the Metropolitan Electric Company, all three properties now being controlled by the same interests. The Reading Transit & Light Company leases its properties to the Eastern Power Company for a long term of years, with the privilege of purchasing. The Eastern Power & Light Company is under the financial and operating management of William P. Bonbright & Company, Inc., New York, and W. S. Barstow & Company, engineers, 50 Pine Street, New York.

Electricity in Book Binding Plants

Opportunities for the Sale of Central-Station Service with Special Reference to the Processes Involved and the Horsepower Requirements of the Various Machines Employed

Industrial Power Series—Article No. 193

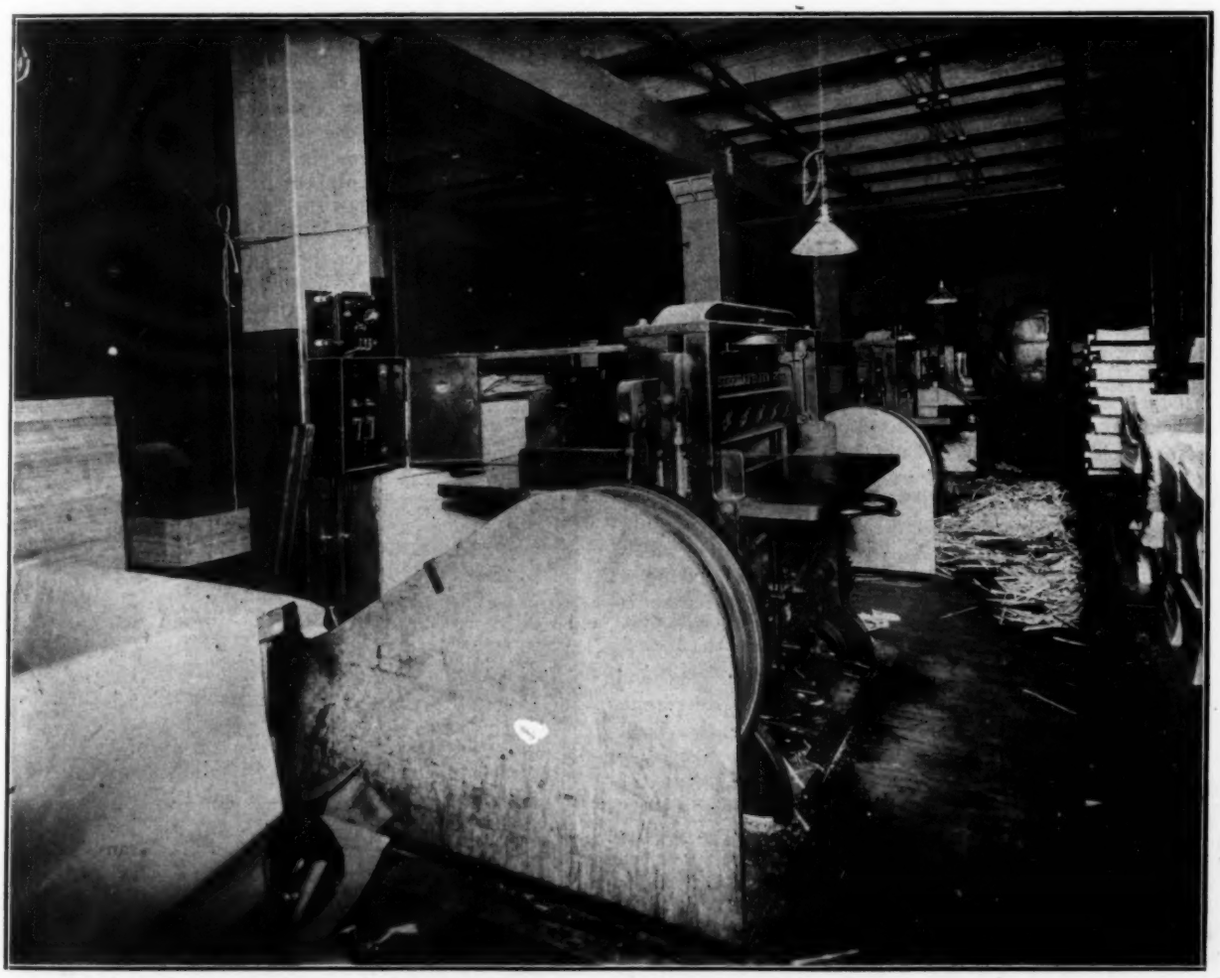
BOOKBINDING establishments offer an attractive field for central-station service and electric motor drive, as this industry is generally located in the business section of cities, in loft or light-manufacturing buildings, where space is rented to many classes of business. By the use of electric drive each concern in a building is entirely independent of its neighbor, in so far as power is concerned, and with central-station service the power is available at any time of the day or night throughout the year.

Cleanliness in book binderies is an important feature, as the material handled is easily soiled, and where long shafts and belts are used there is continual danger of oil and grease, as well as dirt accumulations, dropping on the work. Safety of employees is another feature, as a large number of women are employed in bookbinding, and belts with the attendant speed-controlling and belt-shifting appliances are a continual source of danger unless extreme measures of precaution are conscientiously followed out.

Where individual drive is used a few machines or a single machine can be used independently, and when stopped all power cost ceases. The lighting is improved by eliminating belting and shafting and the hygienic conditions are generally bettered. Enlargement of the equipment is easily made without regard to power, as it is only necessary to run a set of feeders to the motor of the new machine. Machines can be placed for the best handling of materials and the control of the motors is so easily handled that more strict attention can be given to the work, which insures improved quality. By the elimination of shaft and belt friction the annual power cost is materially reduced and the charge for energy is in direct proportion to the time the various machines are operated. The power requirements of individual machines are small and either direct-current or alternating-current motors are adapted to the work. Where the plant is large the smaller machines may be grouped and driven by one motor if found more expedient.

Details of Process.

Modern operations of bookbinding may be grouped in two main divisions, "forwarding" and "finishing." The



Group of Paper Cutters in Bindery Driven by Individual Motors.

Group of Motor-Driven Stitchers.

former process is for the preservation of the books and the latter for their embellishment. Each department has a number of subdivisions. Sheets are generally received from the printer in bundles containing about a thousand of one kind. The first operation is to fold the sheets in a folding machine in such a manner as to bring the sheets together in regular order. The next process is gathering and collating. Gathering consists of putting together one of each of the various sheets of which the book is made up, and collating is the examination of the numbers 1, 2, 3, etc., which are placed at the foot of the outside page of the folded sections, and which are called signatures. The book is then made solid by placing it in a press. After being pressed the book is prepared for sewing by having indentations made in the back of the sheets by passing them over rapidly revolving circular saws. They are then sewed on a machine, each sheet being sewed around twine bands, which are afterward fastened to the boards.

After removal from the sewing machine, with about an inch of twine left on either side to fasten to the pasteboard cover, the end leaves are applied. The book is then trimmed in a paper cutter. The edges are sometimes colored by being sprinkled with a brush or are marbled, which is accomplished by dipping the edge on colors which float on the surface of gum water. If the book is to have gilt edges, it is placed in a press and a coating of red color applied. The edges are then sized with the white of an egg, and gold leaf laid over the sizing. When the sizing is thoroughly dry the gold is burnished. A coating of glue is applied to the back, which is rounded when the glue is partially dried. The book is then clamped in a backing machine and a roller is passed heavily over the back, which turns part of it over each side of the clamps, making a groove to hold the board of which the inside cover is made. The piece of silk braid or colored cloth which projects over the leaves of the back inside of the cover, and is called the headband, is fastened with glue and the whole back is given a lining of cloth or strong rope paper firmly applied with glue. The open or spring back is then made by applying two thicknesses of paper, open in the center, but fastened at the edges, one thickness of paper being attached to the back of the book and the other thickness to the leather or other material of which the outside is made. The book is then ready for the cover. The cover or case is made by boards being cut larger than the leaves of the book, over which the outside material is fastened by glue, a space being left between the two boards large enough to fit the back of the book in, the boards being required to fit nicely into the grooves made in the backing. The edge of the board is frequently ground off on a rapidly revolving emery wheel, which gives it a beveled edge. The book is then ready for embellishment. In very large bookbinderies machines are used which perform many of the processes automatically, and electric glue heaters are used to some extent on the machines.

Owing to the variety of work performed, bookbinding machinery as a rule requires a certain degree of speed variation in order that, with a given equipment and force of operatives, the maximum of high grade production may be turned out. All necessary speed variations are most readily, economically and satisfactorily obtained with electric drive and control. Each machine is at all times under instant control, so that the entire attention of the operator may be devoted to the work in hand.

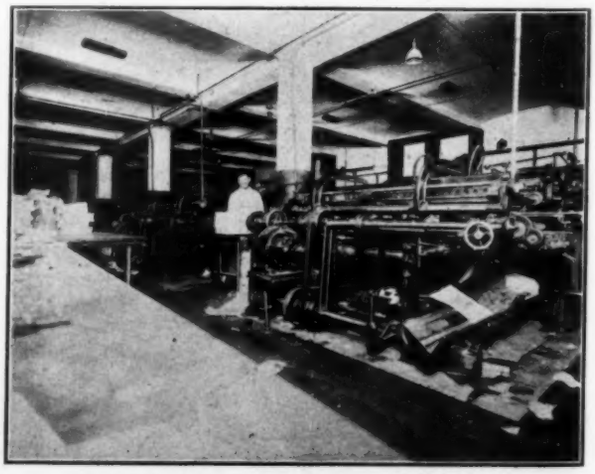
Reliability is, of course, of vital importance, particularly in plants binding magazines, etc. The reliability of central-station power is too well known to need further comment here. However, with individual motor drive in case of breakdown of a motor or machine it is not necessary to shut down the entire plant, as is necessary with other forms of power.

Selection of Motors.

In deciding upon the field winding of motors for driving bookbinding machinery, the circumstances of the drive must be considered. A plain shunt motor is most suitable where it is desired to drive groups of machinery by means of shafts and belting, and in all cases where constant speed is required. For driving machines direct through spur or chain gearing the motor should be compound wound so as to give a larger starting torque. To overcome the initial torque of the driven machine there are an endless variety of combinations between shunt and series windings which can be arranged, and it should be borne in mind that the greater the percentage of series turns, the larger will be the starting torque, whereas constancy of speed is more and more sacrificed as the series field is increased.

With proper compounding, a smaller size frame may be used than when the percentage for series turns is too small, because it is often the case with bindery machinery where there are heavy peaks in the load that the sparking limit is reached before the overheating limit, and it is necessary not only that the motor should be large enough to do its work without overheating, but also it must be large enough to take peak loads without sparking.

Interpoles are now largely used by manufacturers to get over this difficulty. The interpole machine is no more efficient than any other, but will allow of a greater overload being carried temporarily without its reaching the sparking limit. The use of interpoles, therefore, enables



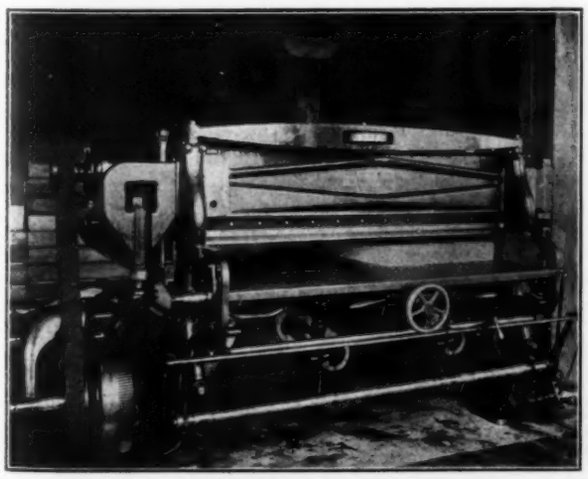
Battery of Folders Driven by Individual Motors.

the load to vary, so as to cause sparking, even though the average load is not more than the motor is designed to carry.

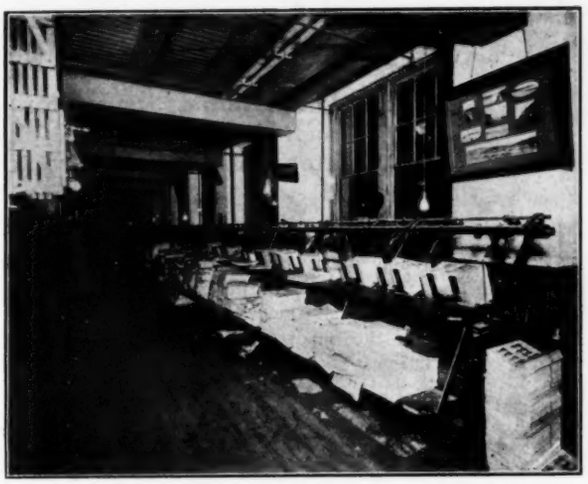
Alternating-current motors give equal satisfaction for bindery drive. Where a constant speed is required the squirrel-cage induction motor is recommended. For variable-speed machines the motors should be provided with slip rings by which resistance is introduced into the rotor for decreasing the speed.

The accompanying table gives the sizes of motors recommended for various bookbinding machinery.

Machine	Horsepower Required
Lathan Monitor stitcher	0.5
Hickok ruling machine	0.25
Hickok knife grinder	1
Hickok round-corner machine	0.25
Morrison wire stitcher No. 2	0.125
Morrison wire stitcher No. 4	0.25
Morrison wire stitcher No. 12	0.5
Dexter folders, No. 121, Standard	2
Dexter folders, No. 122, Special	3
Dexter folders, No. 125	2
Dexter folders, No. 131, quadruple	2
Dexter folders, No. 132, quadruple	3
Dexter folders, No. 44	0.75
Dexter folders, No. 80	1
Dexter folders, No. 93	2
Dexter folders, No. 148	3
Sheridan die presses, 44 by 22 in.	2
Sheridan die presses, 33 by 18 in.	1
Sheridan rotary shears	0.75
Sheridan arch embosser	1
Sheridan one-inch horizontal covering machines	2
Sheridan case maker	2
Sheridan gathering machine	1
Sheridan hand-clamp book trimmer	1
Sheridan automatic book trimmer	1
Sheridan new mill cutters	3 to 5
Sheridan 34-inch perfection cutter	1
Sheridan hand-clamp cutter	1 to 2
Sheridan automatic paper cutter, 36-inch	1
Sheridan automatic paper cutter, 50-inch	2
Sheridan automatic paper cutter, 65-inch	3
Sheridan automatic paper cutter, 75-inch	5
Book pasting machine	1
Book trimmer	3
Book smasher	3
Book sewing machine	1.5
Book embossing machine	3 to 10
Book stitcher	0.25
Book punching machine	0.25
Book paging machine	0.125
Board cutter	1
Profiling machine	1
Gold-dust machine	0.25
Book stamp	2 to 5
Ruling machine	0.25
Round cornering machine	0.5
Book gumming machine	0.125
Prouty perfecting press, 12 to 18	1
44-inch Oswego cutter	2
36-inch Oswego cutter	1
48-inch Sanborn cutter	2
Seybold embosser	5
Cardboard splitting machine	1
Victory embossing machine	1
Ink mills	1 to 7.5
Blackhall embossing machines	0.5
48-inch Brown folder	2



Motor-Driven Paper Cutter.



Motor-Driven Gathering Machine.

Report of Commissioner of Patents for 1916.

In his report of the activities and financial condition of the U. S. Patent Office for the year ended December 31, 1916, Patent Commissioner Thomas Ewing states that the total receipts of that office during the year were $2,343,540.94 and the expenditures, $2,115,367.91.

The activities of the Patent Office are of much interest to the electrical fraternity, because electrical patents make up one of the largest single classes which are handled by the Patent Office. The total number of applications received during the year was 71,033 and 45,927 patents were issued. There were 23,296 patents which expired during the year; 11,174 applications were forfeited for nonpayment of fees and 19,835 applications allowed. Taken as a whole the figures as given in the report show a very marked increase over the activities of 1915.

With reference to the average time of pendency of applications, the showing as to promptness is satisfactory. The average time that applications upon which patents are granted are in the Office is 21 months, and 97 per cent of all applications are disposed of within five years. As conditions now are, important patents are frequently unduly delayed. The proper way to handle the business is to require prosecution of all applications as rapidly as is reasonably possible. The plan of assigning this particular duty to one of the law examiners has been continued.

The total decrease in the number of applications pending in the examing divisions or on appeal (omitting allowed and forfeited applications) is 5,170. It thus appears that the Office completed its examination of about seven and one-half per cent more applications than it received during the year. This does not indicate that the corps is unnecessarily large. It is in pursuance of a definite policy to require prompt prosecution by applicants and their attorneys. The method by which the Office can force the prosecution of applications is to hold the applicant strictly to the rule requiring complete response to each Office action.

Permanent Quarters for Engineering Association of Nashville.—The Engineering Association of Nashville, Tenn., has opened its new quarters at 409 Commercial Club Building, including the office of the secretary and a technical reading-room. The association holds a luncheon each Monday at 12:30 o'clock, with the exception of the first Monday in each month when a dinner is held at 6:30 o'clock, followed by a business meeting and a paper or address on some pertinent topic. Visiting engineers are always welcome at these events and at the quarters of the association. Robert B. Shapinsky is secretary.

Factors in Electric-Range Sales

A Discussion of the Factors of Turnover and Seasonability Which Are to Electric-Range Merchandising What Load-Factor and Diversity-Factor Are to the Central Station

By J. E. BULLARD

THERE is probably no central-station man who does not appreciate the importance of increasing both the load-factor and the diversity-factor. It is this almost universal recognition of the importance of this phase of the business that has had a great deal to do with the marvelous growth of the electrical business during the past 25 years. These two factors, however, are nothing more nor less than those which department stores and other large and prosperous merchandising establishments have observed in building up their businesses.

What the load-factor is to the central station, turnover is to the merchant. What the diversity-factor is to the central station, seasonability is to the merchant. A high-load factor by making the demand for energy more uniform results in a low overhead cost per unit of output. In the department store, the frequent turnovers of the capital invested in stock similarly reduces the overhead costs. In the central-station business a diversity of consumers by diversifying the demands helps increase the load-factor. In the store the practice of confining the stock in so far as possible to seasonable goods that are in season as long as there are any left in the store tends to keep the sales per day uniform and thus make possible the greatest frequency of turnover.

TURNOVER AND SEASONABILITY

Every central-station man realizes the importance of load-factor and diversity-factor in a distributing system but these factors, which in merchandising are equivalent to "turnover" and "seasonability," are usually lost sight of by the appliance department.

The lesson that the central station can learn from department stores in regard to these important factors is the basis of this article, which is predicated on the assumption that appliances are sold at a profit.

In the past central stations have never done very much merchandising. It is true that some companies have done a considerable business in portable lamps, small appliances, etc., but on the whole the idea has been more to display and advertise these appliances rather than to make an actual business of selling them. Now, however, there is promise that the majority of electric light companies will soon be doing a large merchandising business. For many years the gas companies have been doing such a business and now that central stations are preparing to compete with gas in every field, they will doubtlessly enter the merchandising field.

Central Stations Must Sell Ranges.

There is every reason to believe that nearly every central station with a special cooking rate will find it advisable to sell and install electric ranges. It will be only a step from selling ranges to selling all other appliances that consume central-station current. The bulk of the gas-range business has always been done during the hot summer months and there is strong evidence that the same will hold true of electric ranges. This means that it either will be necessary to engage temporary selling forces each season, or to find some other work for the selling force to do in "off" seasons.

It has been proved time and time again, and often at very great cost, that a temporary sales force is a very expensive sales force. If the sales people work only during the summer months much time and expense is devoted to training them only to have them leave as soon as there is promise of everything working smoothly. Not only is this the case but the best men and women will not work on such temporary propositions. They do not have to do so. They already have permanent positions.

These temporary employees are not working for the interest of the company. They know that their jobs will not last long and that they will have to make the very best of all their opportunities. They, therefore, are going to get just as much out of them as they can. They are going to try to get the greatest possible sum of money for the least possible work. In some cases they will use any method at their command to get this money easy. It, therefore, is self-evident that no self-respecting electric lighting company can afford to depend upon temporary sales forces for the sale of electric ranges. Since this is the case it will be wise to study the methods used by department and other stores that handle large quantities of seasonable goods and have had these same problems to solve.

Such a study shows that the department stores make special efforts to push those goods which are in season. In some cases the store may have been obliged to go so far as to create a demand which slightly changes the season in which certain goods are salable. In all cases, however, it will be found that the store pays a great deal of attention to seasonability. In these stores you are not likely to be able to make a satisfactory purchase of a heavy ulster in the summer time or of a straw hat in the winter time. The store also arranges its purchases in such a manner as to keep the sales as nearly as possible uniform from day to day and from month to month. In other words it studies the seasonability of merchandise with the object in view of using this knowledge to increase the frequency of turnover and thus increase the profits by reducing overhead expense per dollar of sales. It works out in just the same way as it does with the central-station manager when he studies the diversity of load in his district with the object of increasing his load-factor and thereby the profits of the business.

In most parts of the country the busy season for the sale of electric ranges will be found to be the months of May, June, July and August. During these months it will be necessary for the company to carry a large stock of ranges and every sales person who sells domestic appliances will be kept very busy selling electric ranges and water heaters. Ranges, of course, like groceries are an all-the-year commodity. However, just as the demand for spices is the greatest during the preserving season the demand for ranges is the greatest during the hot summer months. During the remainder of the year it will not be necessary to carry so large a stock of ranges and it will not be profitable to attempt to keep all the domestic-appliance sales force busy trying to sell ranges and water heaters. If such an attempt is made it will be found that after everyone has done the very best he can the results do not pay the expense of carrying the force.

Fortunately, however, there are many electric appliances other than ranges that can be sold for household use. Among these are vacuum cleaners, sewing-machine motors, small portable cooking appliances, irons, washing machines, heating pads, general utility motors, and various other appliances that can be sold at any season of the year. In fact by judicious adver-

tising seasons can be created for these goods at the will of the central station. This makes it comparatively easy to plan the merchandising work ahead in such a manner that the whole force can be kept busy the year round. It is also fairly easy to make each month show an actual profit. In other words to make the domestic-appliance department more than pay for itself out of the profits made on sales which means that the increased electric revenue has cost the company nothing.

Unwise to Operate Appliance Department at a Loss.

It is a very grave mistake for any public utility to operate a merchandising department at a loss. There is no more reason why such a department cannot be successfully operated at a profit which will make it look very attractive to all the stockholders than there is why a department store should be operated at a loss. Should the practice be persisted in of selling merchandise at a loss there is grave danger that the ill will engendered among the merchants in town will more than offset any advantage which may seem apparent.

With a permanent sales force it is just as easy to sell merchandise at a profit as at a loss. In fact it may be easier. When it is sold at a profit the company can afford to employ better sales people and accordingly will have a much better and a much more efficient sales department. This means much better salesmanship will be employed in making sales. As a result the purchaser consumes more electricity than would otherwise be the case. She is also much better satisfied. She has become convinced that electric cooking is by far the best cooking and, therefore, worth more than she has been paying for gas, oil or coal. The company is bound to be satisfied because at no cost to itself the consumption of energy has been materially increased. The salespeople are satisfied because they have permanent positions at good pay and with a future ahead of them. The dealer, the contractor, and all others connected in any way with the sale of electrical appliances are satisfied because instead of hurting their business the central station has built up a demand by its progressive methods which enables them to do more business and make more money. Accordingly they all boost for electricity, and everything electrical.

To make a real profit, however, and bring about the ideal condition that has just been pictured the department must be operated with as much wisdom as the best department of any good department store or other successful retail store. This means very careful buying and very careful planning of all sales campaigns. The months during which it will be easiest to sell certain appliances will have to be very carefully selected. Already the National Electric Light Association is working along this line. Each sales manager, however, will have to rely to a very great extent upon his own judgment. Each individual condition differs to some extent from all others and he will have to do much of his own planning in regard to the details of working into the larger scheme.

Load-Factor and Diversity-Factor in Merchandising.

There are some companies that are already making thousands of dollars in annual profits from the sale of appliances. These companies buy carefully and make special efforts to sell each class of goods when there is a natural demand for them and the sales force is best able to handle them. They have applied the principles of load-factor and diversity-factor to their merchandising as well as to the sale of their energy. These companies never allow old or shop-worn goods to remain in their stock rooms. They never wait till the end of the year before clearing as much as possible of their old stock. They rather clear out all the shop-worn and otherwise unsalable stock at the end of each selling campaign. In this way they not only keep their capital invested in stock very active but also secure the maximum prices for the left-overs since they are sold while the public is still buying and is glad to secure a bargain. Dead stock encumbering the stock room has been the cause of the downfall of many otherwise good merchandising men. It is the very active manner in which they move their stock that keeps department stores going. If the corner grocery store could turn its capital over as many times a year as does the department store it would soon be able to drive the department store out of business. The reason why the average cost of electricity has been reduced during the past 25 years at a more rapid rate than that of gas is simply due to the fact that the electrical men have had a keener realization of the importance of reducing the overhead charges by continually improving the load-factor.

It will never be necessary for the central station to actually spend money to introduce electric ranges. If it pays as much attention to the seasonability of appliances and the rapid turnover of the capital invested in appliances as it has to the diversity-factor and the load-factor in the sale of current there will be no difficulty in making the domestic-appliance department more than pay its own way. It may even be possible to make it the most profitable department of the company. It is all a question of merchandising and the great underlying principles of successful merchandising are a full appreciation of the importance of the factors of seasonability and quick turnovers.

Electrical Exports for December and for the Year 1916 Set New High Values.

As was indicated by the trend of its last few months, the total value of the electrical exports of the United States during 1916 broke all previous records and the month of December exceeded all preceding monthly totals. These facts are disclosed in the monthly summary of the foreign commerce of the United States, just issued by the Bureau of Foreign and Domestic Commerce, Washington, D. C. The total of electrical shipments in December exceeded that of the corresponding month in 1915 by over 118 per cent.

The detailed comparative figures for these two months are given in the following table:

Articles.	Dec., 1916	Dec., 1915
Batteries	$212,457	$110,164
Dynamos or generators	305,759	116,383
Fans	23,422	20,308
Insulated wires and cables	630,732	174,886
Interior wiring supplies, etc. (including fixtures)	110,750	76,967
Lamps—		
Arc	1,146	3,392
Carbon-filament	16,297	23,945
Metal-filament	128,394	120,998
Meters and other measuring instruments	102,832	68,463
Motors	526,952	233,250
Telegraph instruments (including wireless apparatus)	15,654	14,201
Telephones	301,107	87,722
Transformers	86,370	50,477
All other	2,284,965	1,076,182
Total	$4,746,837	$2,177,338

In the following table is given a summary of the monthly electrical export totals throughout 1916:

Months, 1916.	Electrical Exports
January	$2,320,822
February	2,942,611
March	2,884,875
April	2,630,169
May	3,437,609
June	3,150,144
July	2,993,857
August	3,595,735
September	3,491,217
October	4,045,645
November	4,421,535
December	4,746,837

The following table gives an annual summary for the last five years. This shows that 1916 exceeded 1915 by over 65 per cent. in the value of electrical shipments, and was considerably over twice 1914, which was the year of serious depression brought on by outbreak of the European war.

Calendar Years	Electrical Exports
1912	$23,212,813
1913	28,197,363
1914	19,963,115
1915	24,341,588
1916	40,241,640

Speed-Torque Curves of D. C. Motors

Some Notes on a Rapid Graphic Method of Determining Speed-Torque Characteristics of Series and Compound-Wound Direct-Current Motors—Example Worked Out

By B. H. CHATTO

IT IS sometimes necessary to calculate the performance of a series or compound-wound motor over a wide range of load. Such a calculation is of necessity a step-by-step process involving considerable figuring. The graphic method to be outlined in the following enables the designer to make these calculations with a minimum of work, and offers a ready means of analysis when changes are to be made in the design.

It is assumed that the winding to give the required full load has been determined and that a magnetization curve of the motor is available. In order to explain the curves, we will calculate the performance of a one-horsepower compound-wound motor. The data necessary are given in Table I.

TABLE I

Horsepower	1
Volts	115
Revolutions per minute	1,700
Armature resistance at 25 degrees centigrade (R_a) (ohms)	0.885
Total armature conductors (N_c)	720
Series-field resistance at 25 degrees centigrade (R_s)	0.388
Total series turns	140
Shunt-field resistance at 25 degrees centigrade (R_f) (ohms)	297
Total shunt turns	4,400
Poles	2
Brushes (⅝ inch by 1 inch)	2
Iron loss at full load (watts)	36
Brush friction (watts)	23
Bearing friction and windage (watts)	18

The magnetization curve is given in Fig. 1.

On cross-section paper (see Fig. 2) lay off armature amperes as abscissas, and vertical scales representing resistance drop (IR), ampere-turns, revolutions per minute, and flux. In this calculation the unit of flux is taken as the Kapp line (equal to 6,000 c. g. s. lines) in order to simplify the formula for revolutions per minute.

The IR drop in the armature and series field equals $1.2\times(R_a+R_s)\times I_a$, when the copper is at 75 degrees centrigrade. When I_a=10 amperes, IR=15.3 volts.

Plot this point and draw the line OE through it and the origin.

At 10 amperes the brush density is 10/0.375=26.7 amperes per square inch, and at 20 amperes 53.4 amperes per square inch. For these densities the brush manufacturer's curve gives 1.4 volts and 1.46 volts, respectively. Add these figures to the drop at 10 and 20 amperes from the line OE and draw the line $O'E'$ through the two points obtained. This approximation of the brush drop is close enough for practical work.

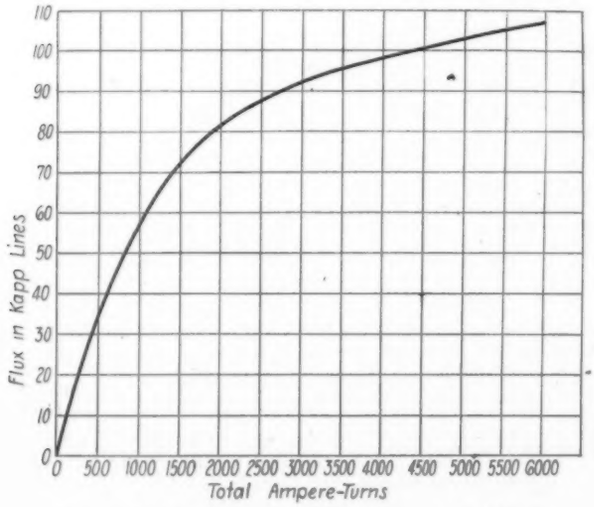


Fig. 1.—Magnetization Curve of Compound Motor.

Next subtract the volts at any two points on $O'E'$ from 115 volts and plot these points to the counter-electromotive-force scale. The line MN drawn through the two points thus obtained is the counter-electromotive force induced throughout the range.

The shunt-field ampere-turns=4,400×115/(1.2×297)=1,420. The horizontal line AB represents the shunt-field ampere-turns, which are constant at all loads.

The line AC, representing the total ampere-turns, is obtained by adding the series ampere-turns at 10 amperes to the shunt ampere-turns and drawing the line through that point and the point A.

Next estimate the armature demagnetizing ampere-turns at 10 amperes and draw the line OX.

The demagnetizing ampere-turns, sometimes called the back ampere-turns, are calculated by the formula

$$a.t.=4S_1\times Ni/S_2$$

where S_1=number of commutator segments back shift of brushes.

S_2=commutator segments per pair of poles.

Ni=armature ampere-turns per pair of poles.

There is also a reduction of the flux due to the distortion, the calculation of which is somewhat involved. Since the ampere-turns required to overcome the effect of distortion seldom exceed two or three per cent of the armature ampere-turns, this point may be neglected or approximated.

The point D is obtained by subtracting PX from PC and the line AD represents the useful magnetomotive force.

The flux curve is now plotted, using Fig. 1 and the values from AD.

We are now ready to calculate the speed curve. For a two-pole motor and flux plotted in Kapp lines,

$$\text{Speed (in r. p. m.)}=E\times 10^8/(N_c\times\phi)$$

where E=counter electromotive force and ϕ=flux. For summary of the remaining calculations see Table II.

The torque formula (see Foster's Handbook) is

$$T=117\times N_c\times I_a\times\phi\times 10^{-11}$$

reduces to $T=702\phi\times N_c\times I_a\times 10^{-8}$ for a two-pole motor and ϕ expressed in Kapp lines. The

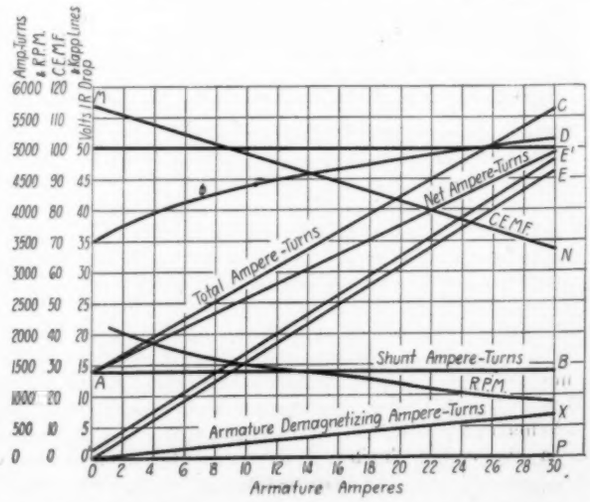


Fig. 2.—Graphic Determination of Speed-torque Curve.

value of T given by the formula may be called the gross torque.

TABLE II.

Armature Amperes	Line Amperes	E Volts	Speed R.P.M.	Torque Gross	Torque Net	Horse-power	Efficiency Per cent
1	1.323	112.5	2140	0.37	0.04	0.016	7.8
2	2.323	111	2050	0.76	0.43	0.168	47
6	6.323	104.5	1760	2.5	2.27	0.735	75.3
10	10.323	98.5	1560	4.42	4.09	1.215	76.5
14	14.323	92	1390	6.5	6.17	1.64	74.3
18	18.323	86	1255	8.63	8.3	1.98	70.2
22	22.323	79.5	1125	10.9	10.57	2.26	65.7
26	26.323	73.5	1015	13.2	12.87	2.49	61.2
30	30.323	67	907	15.6	15.27	2.64	56.5

The torque required to overcome iron loss, friction and windage must be subtracted from T to obtain the torque available at the motor shaft.

Although it is possible to calculate to a fair degree of accuracy the iron loss, friction and windage for a number of points, such a procedure requires more time than is justified.

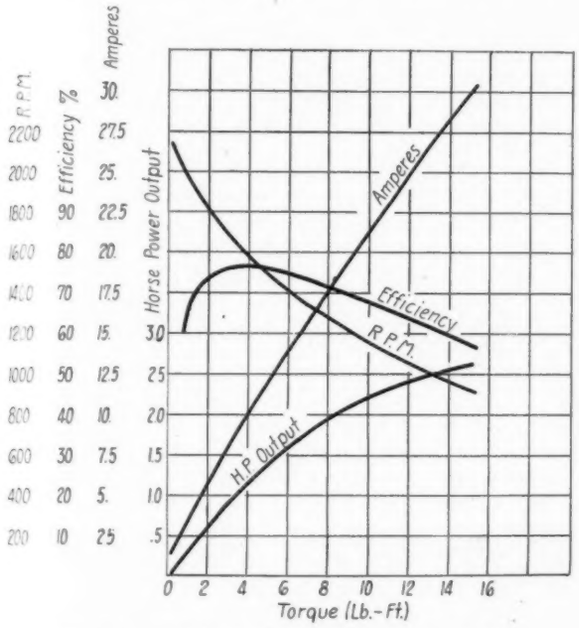


Fig. 3.—Complete Performance Curves of Motor.

A good approximation may be had by calculating the torque lost at the full-load point and assuming this to be constant at all loads. From Table I the iron loss, friction and windage equal 79 watts at 1,700 revolutions per minute.

79 watts=0.106 horsepower, requiring 0.328 pound-foot torque.

From data in Table II complete performance curves of the motor may be plotted (see Fig. 3).

For short-time ratings the designer should bear in mind that the temperature of windings rises very rapidly, so that if overloads are sustained for several minutes, the IR drop may be higher than calculated, consequently there is a tendency for the speed curve obtained by the brake test to be lower than the calculated curve at the overload points.

Dr. S. S. Wheeler Opposes Use of Electric Drive on New U. S. Navy Dreadnaughts.

Dr. S. S. Wheeler, president of the Crocker-Wheeler Company, Ampere, N. J., and past president of the American Institute of Electrical Engineers, has written an article which has been published in the New York *Sun*, January 29, 1917, opposing the use of the electric drive for the four new battle cruisers for the United States Navy, the contracts for which are about to be let.

Dr. Wheeler considers that the experience with electric drive on the collier *Jupiter*, which utilized machinery of 6,500-horsepower capacity, is not a criterion of the working of the larger electrical installation proposed for one of the new battle cruisers.

Legislative Matters in Massachusetts Affecting Public Utilities.

Various bills have been introduced in the General Court of Massachusetts that affect electric lighting interests, and hearings have been held the past two or three weeks by the Public Lighting Committee. A bill which provided for investigation of electric lighting rates in the state was speedily thrown out by the committee as unnecessary.

A hearing was held February 13 on a proposed measure to value the properties of the Boston Edison Company and the Boston Consolidated Gas Company, a commission to be entrusted with the task. Advocacy was mostly confined to representatives of the Dorchester Board of Trade who favored municipal acquisition of the plants.

E. W. Burdett, for the Edison Company, pointed out that there is no extensive sentiment for city ownership and that the valuation proposed would take two years and cost $150,000.

Another bill provides that when the record of current consumption is divided into primary and secondary charges, the multiplier or other means of obtaining the primary charge shall be plainly stated, and a copy of the reading, with the multiplier stated, shall be delivered to the customer on request.

Representatives of the Edison Company pointed out that the readings of demand meters involve a variable factor, which requires careful computation at the office, and hence cannot be given at the time of reading by the meter reader.

House bill 881 seeks to compel the Boston Edison Company to provide service where six residents or more on a street or way within 1,000 feet from one another and not more than a mile from existing service, demand service; also when any individual owning property within 250 feet of existing service shall so request.

Mr. Burdett of the Edison Company stated that the company's policy is to make extensions wherever prospective business warrants. In other cases, a guarantee of return on the investment is required, and this is shared in by customers who may later take service from the extension. The difficulty of providing service to single houses that are built on new streets in the outskirts is the fact that in many cases overhead construction is not allowed by the city authorities and the cost of underground construction makes such extension prohibitive in cost.

Project Advanced for Leasing Water Powers in Maine.

The Pepperell Manufacturing Company, Biddeford, Me., contemplates leasing its water-power rights on the Saco River to the Cumberland County Power & Light Company, Portland, Me., if terms can be agreed upon. It is proposed to supply energy for mill operation from the enlarged Cumberland County company's system. The Pepperell company some time ago leased its water privileges at Hiram Falls to the Portland company, and a large hydroelectric plant is under construction, as noted in a previous issue.

Experiments have been going forward for some time at the Pepperell company's mills to determine the cost of electricity generated by steam. With the figures as a basis a contract with the Cumberland County company may be made. Other mills will probably follow with central-station service.

New York Engineers Form Country Club.—A group of well known engineers of New York, N. Y., has organized the Engineers' Country Club and has acquired about 240 acres of highly cultivated and cleared land on the north shore of Long Island near Roslyn, N. Y. The properties will be quickly developed into what promises to be one of the most complete country clubs in the United States.

COMMERCIAL PRACTICE

New-Business Methods, Policies, Rates and Kindred Central-Station Matters for the Man Engaged in Selling Electricity

Links in the Chain of Central-Station Service.

In a well designed advertisement appearing in the daily papers, the Union Electric Light & Power Company, of St. Louis, is pointing out the advantages to be secured through its various departments—links in its chain of service. As will be noted from the accompanying reproduction of this advertise-

KEOKUK DAM
Links Welded
in the Chain of
"The Electric Company's Service"
We offer to our customers not only adequate supply from our fully equipped and modern power plants, sub-stations and distributing systems, but also
AN UNEXCELLED GENERAL SERVICE
which ranks second to none.
WE ANNOUNCE THESE NEW LINKS
IN OUR CHAIN OF SERVICE.
DAILY DELIVERY OF INCANDESCENT LAMPS.
Order lamps in person or by phone before 5 P. M. week days and 12 noon Saturdays and they will be delivered to you the following day (except Sunday) regardless of the section in which you live.
DAILY DELIVERY OF ELECTRIC APPLIANCES.
Our rapid automobile delivery will also bring you any appliances you may purchase.
APPLIANCE REPAIR MEN AT YOUR SERVICE.
If any of your appliances, purchased from us, need repairing phone for the appliance repair man and one of this staff of experts will call the following day and wherever possible make needed repairs on your premises. No charge for his time.
Our Industrial Power Engineers, our Lighting Specialists and our Electric Range Experts are at your command and will be glad to consult with you whenever you desire their services.
Union Electric Light and Power Co.
"THE ELECTRIC CO."
12th AND LOCUST
NO DEPOSIT REQUIRED FROM RESIDENCE CUSTOMERS.
TROUBLE SERVICE NIGHT OR DAY.
FREE RENEWALS OF ELECTRIC INCADESCENT LAMPS.
LAMP DELIVERIES EVERY DAY TO ALL PARTS OF THE CITY.
DEFERRED PAYMENT HOUSE WIRING PLAN
APPLIANCE DELIVERIES EVERY DAY TO ALL PARTS OF CITY.
COMMERCIAL AND INDUSTRIAL LIGHTING EXPERTS AT YOUR SERVICE.
BRANCHES
4912 DELMAR
3028 N. GRAND
3012 S. GRAND
SPECIAL APPLIANCE REPAIR MEN.

Effective Advertisement of the Union Electric Light & Power Company.

ment, the principal links in the chain of "The Electric Company's Service" form a combination of the Keokuk dam, Page Avenue substation and Ashley Street plant. On these three service links depend the balance—day and night trouble service, prompt lamp and appliance deliveries, appliance-repair facilities, lamp renewals, no deposit on residence contracts, deferred house-wiring plan and commercial and industrial department services.

The text of the advertisement forms a more detailed commentary of the company's services as set forth in the chain links.

Twenty-five Electric Ranges in a Town of 3,000 and 10 More in Prospect.

The village of Port Clinton, O., with a population of about 3,000, is taking kindly to the electric range. The Port Clinton Electric Light & Power Company reports that four new ranges have recently been installed, bringing the total up to 25, and at least ten more are in prospect. There are also 320 irons in service and 294 miscellaneous appliances. This gives the company an increased day load.

POPULAR MISCONCEPTION OF OVER LIGHTING INJURIOUS TO SALE OF ENERGY.

Eye Strain Usually Caused by Too Bright a Light Source with Too Little Illumination—Education Needed.

The characterization "over lighting" has not infrequently been applied in conversation, and even in print, to offices and work rooms under artificial illumination.

That many such installations are improperly arranged is unquestionably true. That the lighting in many instances inflicts eye strain upon those who are compelled to do close work under such improper lighting is unfortunately true.

From an extended observation of all classes of artificial lighting it is evident, however, that over lighting, in the sense of providing too great a flux of light in a room, is practically non-existent, according to a pertinent statement in the *Mazda Sales Builder,* issued by the Edison Lamp Works. In fact, in the vast majority of instances, an increased illumination would improve the condition for visual comfort.

In the daylight, intensities of over 100 foot-candles, common in offices, are considered by every one to represent the best conditions of lighting. The absurdity of saying that a room is over lighted in which, say 10 foot-candles of illumination are provided, is evident. Furthermore, there are instances of Mazda lighting where 20 foot-candles or more provide most excellent working illumination.

The misconception evidently arises from the tendency of looking at the light source to find the cause of discomfort. In such a case one is likely to see a brilliant and glaring lamp, which is blinding. This is probably the cause of the bad effect, not because of the quantity of light, but because of its brilliancy, or rather the contrast of the brilliancy with a darker background, say the ceiling, the degree of discomfort would be diminished. This effect is easily demonstrated by viewing a brilliant lamp against the blue sky as a background; practically no discomfort will be experienced. Or the glare can be exaggerated by substituting a black background; this condition will be intolerable.

Thus we see that too bright a light source, with too little illumination, is a very bad lighting condition. To correct this in a practical installation, it is usually advisable to reduce the apparent brilliancy of the light source, as, for example, by introducing a translucent material such as opal or frosted glass, so that the apparent light source is larger and less brilliant. But, in addition, it is often desirable to reflect more light on the ceiling background and thus further reduce the contrast. Authorities differ as to just how far this should be carried, but the important thing is to avoid the great excess of contrast so common in older installations, or where modern lamps are used with old-style equipments.

The apparent enlargement of the light source has a further advantage of softening and thus reducing contrasts on desks and machinery. Glossy or glass-covered desk tops, glossy paper and glossy surfaces on machines all tend to produce unpleasant contrast—especially if the surfaces are very dark and thus reflect but little diffused light. This last is a common condition with machinery, and the more modern use of light-colored finishes on machines may well be encouraged.

The introduction of diffusing media means absorption of light. Usually the reduced intensity of diffused light is better for the eyes than the higher intensity from the bare source. It has often been observed that workers demand a higher in-

tensity of diffused light rather than a more glaring light. To insure satisfaction when applying the correction, it is generally advisable to provide larger lamps or more of them. The additional cost is well justified; it is small compared with the increased value of the illumination. Money spent for poor illumination is poor business when a slight addition will produce a value far beyond the entire cost of the lighting. In the ultimate, poor lighting is much more expensive than adequate illumination.

There can be no question that overlighting, as a cause of eye strain in artificial illumination, is a misconception. It certainly behooves those interested in the lighting business to make every effort to see that this prevalent idea is corrected. The misconception is doubly bad: bad for the public who need much education as to the difference between light and sufficient and proper illumination; bad for the lighting business, since it tends to reduce the sale of electricity, lamps, proper reflectors, glassware and other accessories. The interest of the consumers requires that these should be more extensively used.

Electric Comforts and Aids in Illness Featured at Boston.

The Boston Edison Company's February sale of sick-room and nursery specialties is meeting with good success. Statistics show that this shortest month of the year is the least healthful and the central station that sells domestic appliances, as well as the independent dealer, does well to meet the needs of the time by supplying the electrical ministers to creature comforts and allieviators of human ills, as the Boston Company is doing. Several thousand of the accompanying advertisement have been issued in the form of street-car signs.

Phone Beach 3300 for information about any of these articles.

Please send me the "Thermax" Heating Pad as per your February Sale, and charge to my account.

I understand that for sanitary reasons the pad cannot be returned or exchanged unless mechanically defective.

Please send at the advertised prices and charge to my account the following articles I have checked.

Immersion Heater ☐ Vibrator ☐
Milk Warmer ☐ Radiator ☐
Water Heater ☐

Name.....

Address.....

Street-Car Card and Post Card Used in Boston Campaign.

The Boston Edison Company is sending double mailing cards to customers, in connection with a special offer of sick room and nursery comforts for the month of February. On the portion addressed to the customer is an advertisement of heating pads at $4.44; immersion heater, $4.00; milk warmer, $7.50; vibrator, $16.00; radiator, $6.50, and water heater, $6.50.

Byllesby Company Acquires Electric Property at Norman, Okla.

H. M. Byllesby & Company has acquired, through purchase, the electric and ice utility properties of the Norman Milling & Grain Company, Norman, Okla. The electric plant which has a rated capacity of 310 kilowatts in two units and the ice plant which has a capacity of 12 tons per 24-hour day, are now being operated under Byllesby management.

Norman, which is a thriving city of 15,000 population, is located about 18 miles south of Oklahoma City, which is served with electricity and natural gas by the Oklahoma Gas & Electric Company, a Byllesby interest. It is the seat of the State University and the State Hospital, and, due to excellent transportation facilities, will undoubtedly become an important suburb of Oklahoma City. It is connected with Oklahoma City by the main line of the Sante Fe Railroad and also by an electric interurban.

The company at present serves 800 electric metered customers. It has immediate prospects for 100 additional domestic customers and power business amounting to more than 1,000 horsepower. The gross earnings during 1916 were $45,000.

Narragansett Company Rents Electric Flag Signs.

The Narragansett Electric Lighting Company, Providence, R. I., rents electric flags about five feet square at $5 per night, installing and removing them. A specimen flag is displayed, illuminated, in the company's electric shop.

One of the company's recent window exhibits of striking characteristics was appropriate to St. Valentine's Day. The windows were decorated with hearts as a background for comfort and health appliances. The New Method Advertising Company's (New York) animated sign is being used as a feature. This consists of a floating disk bearing a placard and moving about on a glass-topped table, the disk being actuated in response to magnets moved about by an electric motor located within a cabinet beneath the table.

Massillon Company Uses Telegrams As Sales Medium.

In starting a drive to increase the sale of electricity among present non-users of that commodity, the Massillon (O.) Electric & Gas Company, operated by H. L. Doherty & Company introduced an innovation in its sales campaign by sending out telegrams to all such persons, reading: "We are making a special price on house wiring to non-users of electricity in Massillon, beginning February 5. At the present price of electricity in Massillon you cannot afford to be without this wonderful service in your home. May we send our representative to give you this offer in detail? —Massillon Electric & Gas Company."

Union Electric Reduces Rates.

The 8.5-cent electric light rate, enacted by the council and approved by a referendum in November, 1915, has finally become effective in Cincinnati, O. Electricity consumers who have been compelled to pay at the old rate of 9.5 cents a kilowatt-hour, pending the Union Gas & Electric Company's appeal from the lower rate, will receive a refund on overcharges in their bills from November 1, 1916. If the 8.5-cent rate had been sustained by the state Public Utilities Commission or the courts, without any compromise, refunds would have dated from the time the ordinance should have become effective, November, 1915.

POWER ENGINEERING

Problems Involving Motor Applications, Characteristics of Machines, Power Sales Methods and Industrial Electric Heating

CENTRAL-STATION SERVICE EFFECTS ECONOMY IN ICE-MAKING.

Details of the Motor Equipment in Columbia Ice Company's Plant At Pittsburgh.

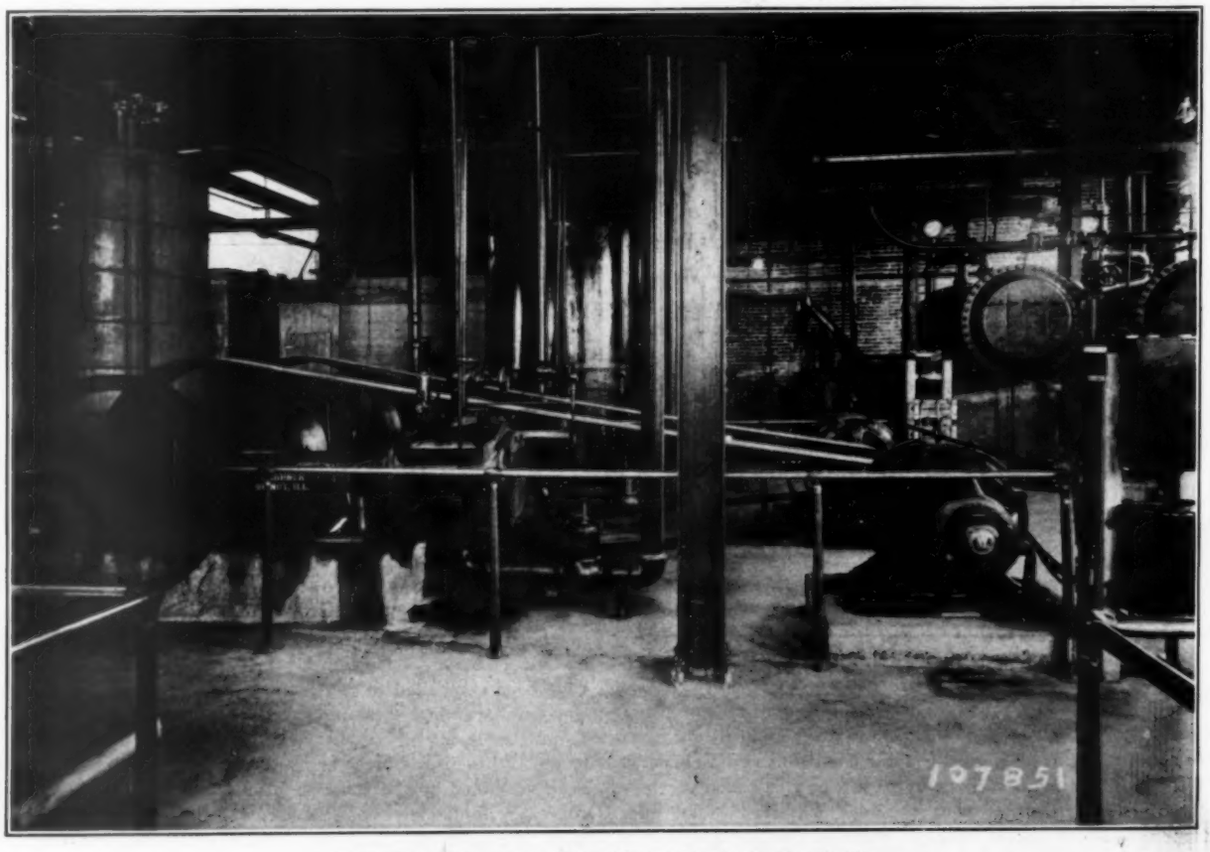
One of the most modern and efficient electrically operated plants of its kind is that of the Columbia Ice Company, Homewood, Pittsburgh, Pa., which produces ice from raw water by what is known as the drop-pipe system. The plant has a capacity of 120 tons of ice per day in 400-pound blocks, and is said to have the reputation of being able to produce a ton of ice at a power consumption of 42 kilowatt-hours. In other words, the company is making ice for less than what it would cost for fuel were the plant steam driven. This is due, in a large measure, to the efficiency of the motor drive.

A total of 400 horsepower in induction motors is installed. Current for the operation of these motors is furnished by the Duquesne Light Company, of Pittsburgh, at 2,200 volts, and is stepped down to 220 volts, by means of three 100-kilovolt-ampere and a like number of 30-kilovolt-ampere transformers. The entire electrical equipment, including motors, switchboards, and transformers, was furnished by the Westinghouse Electric & Manufacturing Company, of East Pittsburgh, Pa.

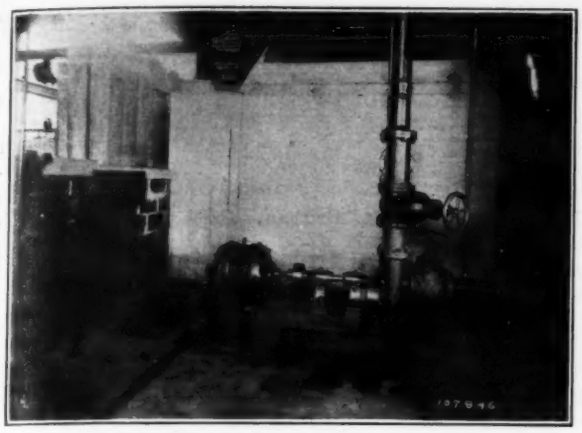
The freezing room contains two tanks, each with a capacity of 720 cans. The York flooded system is employed and the brine in both tanks is kept in constant circulation by means of four brine-circulating pumps, driven by two horsepower, squirrel-cage, vertical motors, running at 850 revolutions per minute. Two York ammonia compressors are utilized, rated at 220 pounds, compression at 20 pounds back pressure. One of the compressors has a capacity of 80 tons and is belt driven by a 250-horsepower, slip-ring motor, 430 revolutions per minute. The other has a capacity of 40 tons, and is belt driven by 100-horsepower, slip-ring motor having a speed of 435 revolutions per minute. Usually only one compressor is operated, the smaller one being held for reserve and for use during summer, when extremely heavy demands are made on the plant.

The water, which is pumped as needed direct from the city supply pipes, is sent from the tank to a cooling tower by means of a centrifugal pump connected by flexible coupling to a 15-horsepower, squirrel-cage motor, running at 1,155 revolutions per minute. The water leaves the cooling tower at a temperature of 75 degrees, and passes to a Shipley-type shell-and-tube ammonia condenser, which it leaves at a temperature of 82 degrees. It then passes through a re-cooler and goes back to the tank again. Thus there is a continuous circulation of water.

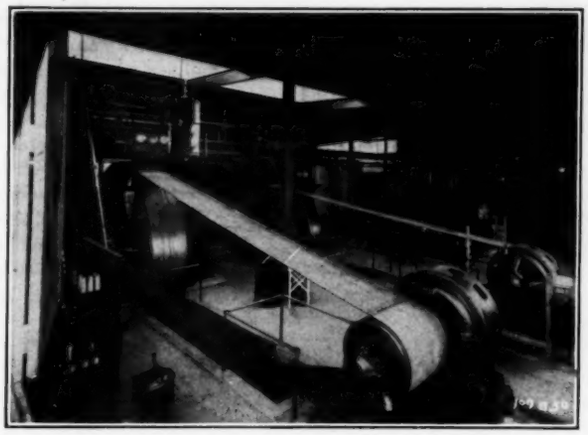
Two 16 by 12-inch Gardner compressors, each of which is belted to a 35-horsepower, slip-ring motor, running at



Motor-Driven Pumps in Columbia Ice Plant, Pittsburgh, Pa.



Motor-Driven Brine Pump in Columbia Ice Company's Plant.



Two York Compressors Driven by 100 and 250-Horsepower Motors Respectively.

585 revolutions per minute, are utilized for furnishing air to purify and clear the ice for 1,440 cans. Only one compressor is operated at a time, however. The air is furnished at 25 pounds, pressure reduced to 18 pounds, passed to a large receiver, and there further reduced to five pounds for use on cans. The air then passes to a two-pipe water cooler, after which it is sent through an ammonia cooler, when the temperature drops, and all moisture is taken out.

The cooler is in the form of a rectangular tower. Air is taken through the cooling chamber of this tower at a velocity of 2,000 feet per minute by means of a Buffalo exhaust fan, driven by a 20-horsepower, slip-ring motor, running at 860 revolutions per minute.

The economies shown by this plant, as well as by others of a similar nature, mark a distinct advance for raw-water ice plants, and proves the superiority of electric motor drive for the ice-making industry.

Breakdown in Isolated Steam Plant Gave Central-Station Opportunity to Demonstrate Advantages.

An interesting incident which shows conclusively the advantages of central-station service over isolated-plant operation occurred recently in Elmira, N. Y., in connection with the breakdown of a 175-horsepower steam engine at the plant of Wyckoff Brothers, manufacturers of wood pipe. It so happens that this plant was engaged in an important contract at the time of the accident, on which there was a heavy penalty for delay in delivery, and as repairs to the disabled engine could not be made for 45 to 60 days the company immediately considered the complete electrification of its plant with power purchased from the local central station.

The Elmira Water, Light & Railroad Company was appealed to and was successful in locating one 75-horsepower, one 45-horsepower and one 40-horsepower motor which were delivered to the Wyckoff plant at once. A contractor was found who was able to begin the wiring immediately. At the same time the line department was brought in from other work, transformers were secured and placed in position, and the next day this plant resumed operation at full capacity, which any central-station man can appreciate was considerable of a feat. It won the very deep gratitude of the Wyckoff people.

The Elmira company had been after the Wyckoff contract for a long while, but owing to the fact that the shavings and sawdust were used for firing the boiler, it was a very difficult prospect. This breakdown has brought the opportunity, however, and the company is endeavoring to develop a market for the shavings and sawdust and expects to be successful.

The arguments of reliability which are so frequently advanced for central-station service are usually discounted until an incident such as this occurs. With motor drive and purchased power a catastrophe such as happened in the Wyckoff plant would be a remote possibility.

IMPORTANCE OF INCLUDING BELT THICKNESS IN COMPUTATIONS FOR MOTOR DRIVE.

A Discussion of Apparent Discrepancies in Speeds, Also of Belt Slip and Creep—Important to the Power Engineer.

By W. F. Schaphorst.

I have heard it argued that belts don't slip as much as we think. A certain gentleman put a belt on a four-inch driving pulley and made it drive a 40-inch pulley. The small driving pulley made 1,000 revolutions per minute. He therefore figured that the speed of the large pulley should be 100 revolutions per minute because 1,000/10=100. The ratio of 4 to 40 is the same as 1 to 10, therefore it seems like a very simple thing to figure this problem.

However, imagine this gentleman's surprise when he found that the driven pulley ran at a speed of a trifle over 105 revolutions per minute instead of 100, and when fully loaded its speed was 103 revolutions per minute. "How does it do it?" he asked. "Instead of slipping or losing speed on account of belt stretch it actually *gains* speed on me."

So, as a matter of experiment, he reversed the drive, making the large pulley the driver and running it at 100 revolutions per minute. He figured, as is ordinarily done, that the speed of the small pulley should be 1,000 revolutions per minute. But he would only get 948 revolutions per minute out of the small pulley, even when no load was being transmitted. When the belt was stressed by a load the best he could get out of the small pulley was 929 revolutions per minute.

Thereupon he started reading what he would find on the subject of belt transmission. He bought a book and studied it carefully, but no good did it do him. He found a parallel problem worked out, giving the same errors he had encountered. He looked into manufacturers' catalogs also, but found no help until he took his troubles to a friend, who is an old hand at belt transmission problems, and this friend at once told him that the trouble lay in the fact that the thickness of the belt was not taken into consideration. "You must always add the thickness of the belt to the pulley diameter in the formulas" counselled the friend.

Thereupon he developed the following formula out of the one that usually appears in books on belts and pulleys:

$$N/n=(d+t)/(Dt)$$

where N=revolutions per minute of the large pulley,
n=revolutions per minute of the small pulley,
D=diameter of the large pulley in inches,
d=diameter of the small pulley in inches,
t=thickness of the belt in inches.

He substituted the values, which I have already given, in this formula, and surely enough obtained 105 as a result when the small pulley was used as the driver, and 948 when the large pulley, as a driving pulley, ran at 100 revolutions per minute. The thickness of his belt was one-fourth inch.

In order to impress this point more forcibly on the reader's mind, I have made the accompanying sketch in an exaggerated way. It shows just how pulley diameters should be measured —including the thickness of the belt. And the sketch also shows why a thick belt will fool the ordinary layman more quickly than will a thin one. If a belt did not have any thickness at all, then and only then, would the simple formula be correct.

Now, coming back to my first sentence, I have heard it argued that belts don't slip as much as we think, on account of this influence of belt thickness. That, however, is not true. Belts *do* slip, and it is a pretty safe bet that they always will, to some extent at least.

It is a simple matter to compute belt slip even when taking belt thickness into consideration. This is done by using the above *correct* formula as a basis and as a result we have this formula:

$S=R(D+t)-r(d+t)$=total belt slip per minute in inches,

where R=revolutions per minute of the driving pulley,

r=revolutions per minute of the driven pulley,

D=diameter of driving pulley in inches,

d=diameter of driven pulley in inches,

t=thickness of belt in inches.

Now, to compute the horsepower lost due to belt slip, use this formula:

$$h.p.=H.P.\times S/R(D+t)$$

Where *H.P.* is the horsepower of the motor given to the driving pulley.

If you will apply these correct formulas to your belt drives you will surely find that every belt that pulls any load at all is slipping to some extent. There is a power loss in every working belt due to either slip or creep. If there is no slip there certainly is creep.

Creep is due entirely to the elasticity in the belt and is unavoidable. So, if you find that you are losing about two per cent of the power when checking with the above forumlas, and if the belts are heavily stressed, you can safely attribute the loss to creep. But if you get a result greater than two per cent, you can generally be sure that something is wrong and power is needlessly going to waste. Slip can be stopped by giving the belt proper care.

A belt that is transmitting power is tighter on one side than on the other. The tighter side is stretched more than

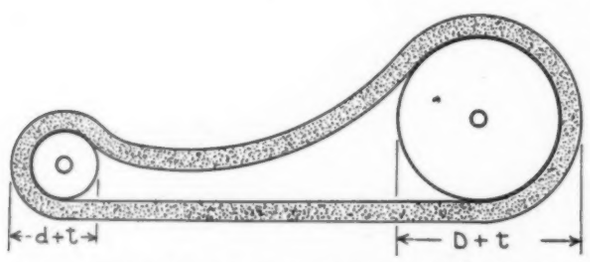


Chart Showing How Pulley Diameters Should be Measured.

the other. We therefore have a longer belt going onto the driving pulley than comes off. The belt naturally has to adjust itself as it goes around the pulley to make up for this difference in length. Hence we have that unavoidable action known as "belt creep."

So, in conclusion, we must agree that belts either slip or creep and every action can be accounted for. But above all, when making your computations, don't forget to include the thickness of the belt. It has been the source of deception in many instances.

Central-Station Services Replaces Oil Engine in Harrisburg Ice Plant.

Two contracts for electric power for refrigerating purposes have been recently secured by the Harrisburg (Pa.) Light & Power Company after two years of persistent follow up. One of these is from the Merchants Ice Company and the other from the Hershey Creamery Company. The installation in the Merchants Ice Company plant displaces a 200-horsepower De La Verne oil engine which has been driving the ice machine, and 27 horsepower in motors is being installed immediately, which will be followed later, that is, before hot weather comes, by 200 horsepower additional which will operate another compressor. The oil engine was installed about two years ago at a cost of about $10,000, but soon proved itself unsatisfactory, and the Merchants company was forced to apply for aid from the power company. At the present time the ice company is enlarging its plant and its entire equipment will be driven by electric power. The oil engine will have to be sold at practically scrap value.

The other contract embraces 225 horsepower in motors, which will drive a 100-ton refrigerating machine and auxiliaries for making ice and ice cream in the plant of the Hershey Creamery Company.

Net Output Best Basis for Computing Costs.

The desirability of a central station stating its unit costs in terms of net output, rather than kilowatt-hours generated, was pointed out at a hearing on the Boston street-lighting contract, recently held by the Massachusetts Gas and Electric Light Commission, by R. J. S. Pigott, formerly professor of Steam Engineering at Columbia University and now power superintendent at the Remington Arms works in Bridgeport, Conn. "The reason it is now well established practice is that such a thing as this might occur: in a certain western municipal plant the figures were all reported in gross kilowatts, purporting to show costs of power. It was afterwards shown that over 15 per cent of output was used in the station itself on account of its being an electric-driven auxiliary station. Costs of energy sent out were thus 15 per cent higher.

"It is the problem for the engineer who designs the station to find out how much he is going to lose in operating it before he has a useful product to sell to the consumer. In a steam auxiliary station the amount of current used within the station does not often exceed 0.5 to 2 per cent. In an electric driven auxiliary station it may go as high as 15 per cent."

Regarding the practice of central-station companies installing storage batteries as auxiliary sources of power, Mr. Pigott held that the practice is falling into disuse. The Dayton Power & Light Company has never found it necessary to use batteries as reserve in connection with lighting service. With larger companies there would be even less inducement for their use than in smaller companies. In street-railway systems it is not at all general practice. The Interboro Rapid Transit Company, New York, abandoned battery equipment it had several years ago. With the increasing reliability of steam-driven exciters, and combination steam and electrically driven exciters, the use of battery equipment for excitation purposes has also declined, the expert declared.

Electric Pumping Costs Less Than by Steam.

A recent report by the superintendent of the city water works of Faribault, Minn., shows that the cost of pumping water by electricity during the past nine months has been $2.55 per million gallons less than the average cost of pumping by steam, which method was used during the previous four years. The electric pumping load is served by the Northern States Power Company which company was instrumental in inducing the city officials to test the efficiency and economy of pumping by electricity.

ELECTRICAL CONSTRUCTION

A Department Devoted to Problems Relating to the Installation, Operation and Maintenance of Electrical Equipment

PROPOSED CHANGES IN THE NATIONAL ELECTRICAL CODE TO BE CONSIDERED FOR BIENNIAL REVISION.

Summary of Proposed Changes to Come Up at Annual Meeting of Electrical Committee, National Fire Protection Association, to Be Held at New York, March 28 and 29.

In accordance with long established custom, the National Electrical Code is to be subjected to its biennial revision this year. The Electrical Committee of the National Fire Protection Association, which is the final advisory body on revisions of the Code to keep it abreast of the progress in electrical construction requirements and practice, will hold an open general meeting on March 28 and 29, at the rooms of the New York Board of Fire Underwriters, 123 William Street, New York City, at which will be considered changes already passed on by the committee or its subcommittees, also numerous suggested changes received by the secretary of the committee. These latter changes will be discussed at a preliminary meeting of the committee. F. E. Cabot, Boston, Mass., is chairman, and Ralph Sweetland, 141 Milk Street, Boston, Mass., secretary of the committee.

In the following is given a condensed summary or digest of the principal changes proposed in the Code.

Changes Recommended by the Electrical Committee.

At a meeting of the committee held March 21 and 22, 1916, the following changes were recommended.

Rule 5*c*. Change in second paragraph permits ground wires of lightning arresters to be run in iron or steel conduits, if electrically connected to both ends thereof.

Rule 12*f*. Addition to third paragraph permits ground for secondary system as per 15*g* to serve as ground for service conduit, but not as ground for interior conduit system.

Rule 12*h*. Amendment to give a more liberal and more explicit requirement as to grounding of metallic sheaths of light or power cables.

Rule 15. Fine-print note under heading to be known as Section *a* and to be amended.

Rule 15*a*. Change to Section *b* and amend so that neutral of three-wire direct-curent systems must be permanently and effectively grounded with two or more grounds at each central station and each substation. Omit detailed rules 1, 2 and 3.

Rule 15*b*. Change to Section *c*, and amend detailed rule 3 to give a more explicit statement regarding the ground connection for transformer secondaries.

Rule 15. Change sections *c* to *g*, inclusive, to be sections *d* to *h*, and add a paragraph permitting use of artificial grounds where water-pipe grounds are not available, provided ground resistance does not exceed 25 ohms.

Rule 30*c*. Amend so that fixture wires must have an approved insulated covering, not necessarily rubber only. For fixtures exposed to high temperatures, slow-burning or other heat-insulating coverings must be used.

Rule 32*h*. Amend to permit use of smooth, well rounded surface at openings of outlet-box covers instead of bushings.

Rule 35*d*. Amend so as to require slow-burning or other heat-resisting coverings for wires used in fixtures for gas-filled incandescent lamps.

Rule 51*k*. Add detail rule 3 to permit for flexible cords for portable heating appliances other types of coverings that are first tested and approved.

Rule 56. Add new sentence at head exempting certain slow-burning wires specially designed and approved for fixtures.

Rule 59*c*. Include conduit-box covers in requirement for insulating bushings for outlet, junction and switch-box fittings carrying wires from conduit to exposed wiring.

Rule 72*q*. Record to give a clearer statement as to bushings for pendent sockets.

Rule 77*b* and *c*. Amend to permit slow-burning or other approved heat-resisting coverings for wires in fixtures subjected to heat.

In the following sections are changes recommended by subcommittees of the Electrical Committee.

Committee on Wiring of Power and Substations.

Rule 2*a*. Amend to provide alternative methods of running conductors from generators to switchboards, etc., and provide for protection of the conductors.

Rule 2*c*. Add requirement that conductors must be carried through floors and fire walls in insulating tubes and not through open spaces.

Rule 5*b*. Add new paragraph requiring lightning arresters of over 7,500 volts to be isolated and, if of oil type, to be put outside or in fireproof compartment.

Rule 6. Omit this rule.

Rule 9. Change headings from "Railway Power Plants" to "Feeder Protection" and amend to require approved overload circuit-breaker in each ungrounded feeder; if of oil type, breakers must be isolated.

Rule 11*a*. Amend to require such location of transformers that no harm can come from either fire or smoke due to burnout. Also add suggestions for transformer locations that meet this requirement.

Rule 11*b*. Amend first paragraph to require grounding of all transformer casings in Class A installations, not only in central and substations.

Committee on Induction Motors.

Rule 8*b*. Add to third paragraph, excepting splices in high-potential motor conductors from the requirement of metal sheaths.

Rule 8*b*. Amend fourth paragraph to give definite requirements for installing conductors for high-voltage motors.

Rule 8*b*. Amend to require conductors for a single motor to be designed for an overload of 10 instead of 25 per cent.

Rule 8*c*. Amend second paragraph to permit starter to serve as switch and circuit-breaker, if it breaks all wires of the circuit and if in running position it automatically opens on overload. Also omit third paragraph, which now prohibits the latter feature.

Rule 8*c*. Amend tenth line of fifth paragraph to permit use of time-limit circuit-breakers with capacity of 110 per cent of motor current rating, instead of 125 per cent.

Rule 8*c*. Change table in fine-print note at end of section, suggesting 200 per cent of motor current rating as maximum capacity of wires for induction motors with high starting currents, where the rated full-load current is above 31 amperes.

Rule 23*e*. Amend the first paragraph and its following fine-print note, regarding the protection of alternating-current motors with high starting currents, by including the changes above outlined in 8*c*, fifth paragraph and its fine-print note.

Rule 44*a*. Change to require high-potential conductors, except in central stations, etc., to be multiple-conductor metal-

sheathed cable in conduit. Apparatus and circuits must be inclosed by grounded metal shields or casings.

Rule 44*b*. Amend to require potheads or similar protection for conductors leaving metal sheaths of cables. Also amend to agree with recommended change in 8*b*, third paragraph.

Committee on Grounding.

This committee has recommended an entirely new rule relating to methods of grounding to be known as 15A. This will be published in full in the next issue. Numerous changes are also recommended in various places in the Code where the method of grounding is referred to, in this case the reference to be this new rule 15A. The principal places so to be changed are in rules 1*c*, 5*c*, 7*a*, 11*b*, 12*f* and *h*, 15*a*, 25*e*, 26*a*, 27*c*, 28*f*, 29*d*, 43*e*, 45*c*, 86*a*.

Rule 15*a*. Change to 15*b*, and require grounding of three-wire distribution systems, except where unexposed to induction, and permit grounding of two-wire systems.

Rule 15*b*. Change to 15*c*, and change exception to unexposed circuits.

Rule 25*e*. Add paragraph suggesting grounding of metal frames of stationary heaters, etc.

Rule 26*a*. Add a new section to read:

(After July 1, 1917.) The neutral conductor on all three-wire circuits and one conductor on all two-wire circuits must have an identifying insulating covering, readily distinguishing it from other wires. This wire must be run without transposition throughout the entire installation.

When one of the circuit wires is to be grounded, connection shall be made to this identified wire and as prescribed in Rules 15 and 15A.

Rule 30*a*. Amend to define four classes of fixtures for which insulating joints and canopy insulators may be omitted.

Committee on Rule 23, Section d.

Amend third paragraph to include receptacles for attachment plugs. Condense fourth paragraph to provide merely for a separate cutout for each receptacle for use of appliances rated above 660 watts. Insert a new paragraph after the sixth limiting fuses for branch circuits of 660 watts to 10 amperes below 125 volts, and to 6 amperes from 125 to 250 volts.

Committee on Fuses, Switches and Meter Installations.

Rule 23*a*. Amend to permit meter potential coils to be connected on supply side of service fuses, where service switch and fuses and meter are in single inclosed unit.

Rule 24*a*. Amend second paragraph to permit connection of meter potential coils ahead of service switch under conditions similar to above.

Committee on Electric Heaters.

Rule 25*d*. Add fine-print note strongly recommending that flatirons and other heaters applied to combustible articles be used with an approved signal or protective device.

Rule 25*e*. Amend to require grounding of metal frames of stationary heaters, ranges, etc.

Committee on Rule 26, Section o.

Add new paragraph at end of section prohibiting deflection of conductors of No. 2 size or larger where they enter or leave cabinets, except where cabinet gutter is not less than four inches wide and conductors enter opposite their panel lugs.

Committee on Thin-Wall Conduit and Metal Molding for Exposed Work Only.

The committee submits without recommendation the following proposed changes: Change the word "molding" to "raceway" in Rules 26*k*, *l* and *m*, 29*a*, *b*, *d*, *e*, 60*c*, *e*, *h*. Also in other places eliminate reference to any component parts, such as backing and capping, and speak of the entire unit as a raceway, except in 60*d*, which is proposed to be amended to cover such unitary metal raceways that are not moldings.

Committee on Theater and Moving-Picture Wiring.

Rule 38*a* 1. Amend to give more definite requirements for arc lamp inclosures.

The committee also recommends a new rule to be known as 38A, as follows:

38A. Moving-Picture Factories and Studios.

For the purposes of this rule a moving-picture factory or studio is considered as that building or portion of a building in which moving-picture films are manufactured, exposed, developed, printed, rewound, repaired, stored, etc.

Sec. a. All wiring must be installed in approved conduit, metal molding or armored cable.

Sec. b. Side-wall lamps must be installed in receptacles inclosed in approved outlet boxes, and must be protected by approved open end guards riveted to the covers of the boxes. Pendent lamps must be equipped with approved reinforced cord, armored cable or armored flexible cord, and must be protected by substantial wire guards.

Lamp portables must be equipped with approved keyless sockets, of approved composition or metal-sheath porcelain type, with handle, hook and substantial guard. The flexible cords for such portable lamps must be approved cord designed for rough usage. The portable cord must carry the male end of an approved pin plug connector or equivalent, the female end being of such design or so hung that the connector will break apart readily at any position of the cable. The connector must be kept at least one foot above the floor.

Lamps at patching tables must be installed in approved composition or metal-sheath porcelain keyless sockets, and must be suitably protected from mechanical injury.

Sec. c. In vaults used for storage of films, lamps must be protected by vaporproof globes, rigidly installed, and must be controlled by a double-pole switch located outside each vault. No lamp portables or electric fans will be permitted in said vaults.

Sec. d. Motors must be of the inclosed type. Motor rheostats must be installed in metal cabinets of such design that all live terminals or contacts are inclosed, leaving only the operating handles exposed.

Switch and Cutout Committee.

Rule 24*a*. Insert after second paragraph statement permitting service switch for three-wire systems with grounded neutral to be so constructed as to permit either outside wire to be opened independently, but neutral not to be opened without opening both outside wires.

Rule 65. A complete new set of specifications of knife switches is recommended, covering sections *c* to *r*, inclusive.

Rule 67. A new arrangement, somewhat condensed and otherwise amended, is recommended for the specifications of cutouts, covering sections *a* to *f*.

Rule 68. A rearrangement and amendment of the specifications for fuses is recommended, covering sections *a* to *k*.

Committee on Circuit-Breakers.

No change recommended in Rule 66*a* to *h*, inclusive, which are to apply particularly to air-brake type circuit-breakers. New sections *i* and *j* recommended, giving tests on oil circuit-breakers and suggestions as to oil.

Committee on Cabinets.

Rule 59*a*. Amend to apply particularly to outlet and flush switch boxes.

Rule 59*i*. Add new section relating to junction or pull boxes, which must in general comply with Rule 70 on cabinets.

Rule 70*a*. Amend to give more explicit definitions of cabinets and cutout boxes.

Rule 70*b*. Amend so that if providing for more than four branch circuits, cabinets and cutout boxes must have back wiring spaces or side gutters.

Add new sections 70*e* to *i*, inclusive, giving requirements of cabinets made of wood or composition material.

Committee on Electric Signs.

Rule 83*b*. Amend third paragraph as to inclosure of sign transformers, flashers, cutouts, etc.; if on or in sign, must be in weatherproof box; if otherwise located, must be in approved cutout box or cabinet.

Rule 83*e*. Amend last paragraph to apply for open work only.

Committee on Wireless Telegraph Apparatus.

Rule 86*a*. New section governing aerial supports. Change present 86*a* to 86*b* and present 86*b* to second paragraph of 86*b*.

Rule 86*e*. Amend by omitting required grounding of condensers.

Rule 86*f*. New section. Transformers, voltage reducers or similar devices must be of approved type.

Miscellaneous Suggestions.

Miscellaneous suggestions have recently been received by Secretary Ralph Sweetland covering proposed charges in 41 rules and about 160 sections of the Code. These have not yet been considered by the Electrical Committee or any of its subcommittees and therefore are not likely to be adopted this year, unless the desirability of their adoption is manifest when they come up for consideration.

Among these miscellaneous suggestions are new tables for rules 8*b* and 28*i*, requirement for reverse-phase protection for elevator motors, details on methods of running services, definite nominal ratings for various classes of outlets, new rule 37*B* on electrically operated organs, amplifying the metal-molding rules to include thin-wall conduits, etc.

Size of Conductors for Supplying a Group of Induction Motors.

The long disputed question as to what is the proper size of conductor to use in wiring a group of induction motors will probably not be definitely cleared up through any change of the National Electrical Code this year. The Subcommittee on Induction Motors, of the Electrical Committee in charge of Code revision, reports on this question as follows:

"The matter of the size of conductors for carrying the current of two or more motors has received the attention of the committee, and data on the subject have been collected. The data at hand indicate that the diversity-factor of the load carried by the conductors for a reasonable period varies greatly and depends on the character of the motor load and the number and size of the motors. For this reason the committee does not feel warranted in recommending changes in the Code along this line at the present time. The subject, however, will continue to receive consideration.

"Attention is called to the fact that there is nothing in the Code to prevent the combined rated capacities of the motors connected to a conductor exceeding the safe current-carrying capacity of the conductor. Undoubtedly there are many cases where a careful study of the conditions before installation will show that advantage may be safely taken of the diversity-factor of the conductor load. It is necessary, however, that the conductors be properly protected by the circuit-breakers or fuses."

This agrees with the comments on this subject on pages 202, 203 and 204 in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of February 3, 1917.

Safe Lamp for Exploring Partitions, Floors, Attics, Etc.

By Henry C. Peck.

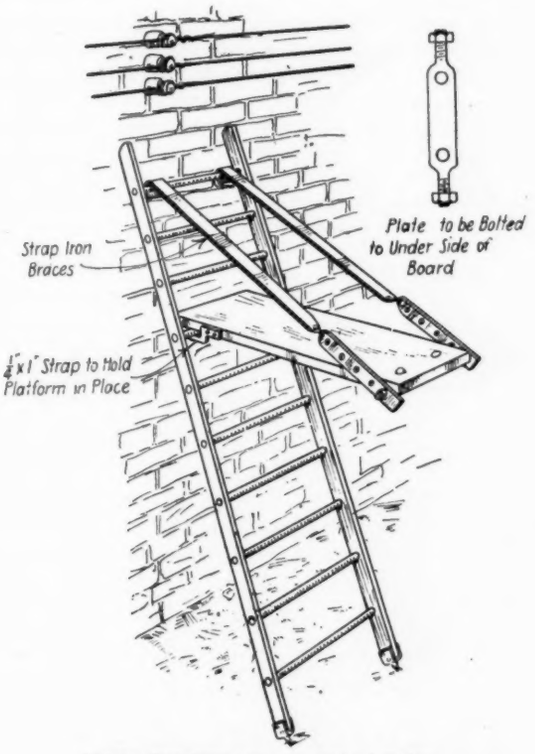
It is still the very common practice among wiremen, plumbers and other craftsmen to use an open candle, sometimes set into the neck of a bottle or fastened on an iron wire, to explode partitions, under floors, in attics, or other dark places where wires or pipes are to be installed or repaired. This is, of course, a very dangerous practice, as it has been shown that many fires have resulted from careless handling or leaving of lighted candles.

For an electrician there is no excuse for using a candle as an illuminant. A very convenient and entirely safe lamp for such exploring or similar purposes may be made by putting a 1.5-volt Mazda lamp in a miniature receptacle and connecting this by a piece of lamp cord with the dry cell that usually is or should be taken along on the job for testing. A lamp of this size may be readily dropped down a partition for the purpose of exploring headers, etc.

Safety Platform for Wireman's Ladder.

By K. F. Kelly.

When considerable work is to be done by a wireman on a wall and at some height above the floor, it is very awkward and positively unsafe to stand on the rungs of an ordinary ladder and work with one hand while holding on with the other. The accompanying sketch shows the manner in which I constructed a simple, portable platform to overcome this difficulty. I have found it particularly useful in a great deal of factory wiring. The board is a one-inch pine board of just enough width to fit easily into the ladder to be used. Two angle straps about one-fourth inch by one inch are fastened to the board to serve as hooks around the rung. In place of these, one or two one-inch cleats may be nailed below the board to fit on one or both sides of the rung and keep the board from slipping. Two long strap-iron braces are bent and twisted as shown to hook over the top rung and engage a double-bolt-ended iron plate below the free end of the board. This plate can be made from five-eighths-inch rod three inches longer than the width of the board; the part of the plate under the board may be flattened out so it may be bolted to the board, or else fastened direct by U-bolts. The ends of the rod or plate are threaded. Holes in the side bars permit the platform to be adjusted so as to be level regardless of the angle at which the ladder is placed against the wall.



Safety Platform for Use with Ladder.

Must Keep Close Tab on the Business

Manager of a Contracting or Other Business Must Constantly Feel Pulse of Concern Through a Comprehensive and Convenient Accounting System—A Form by Which This May Be Done

By GEORGE W. HILL

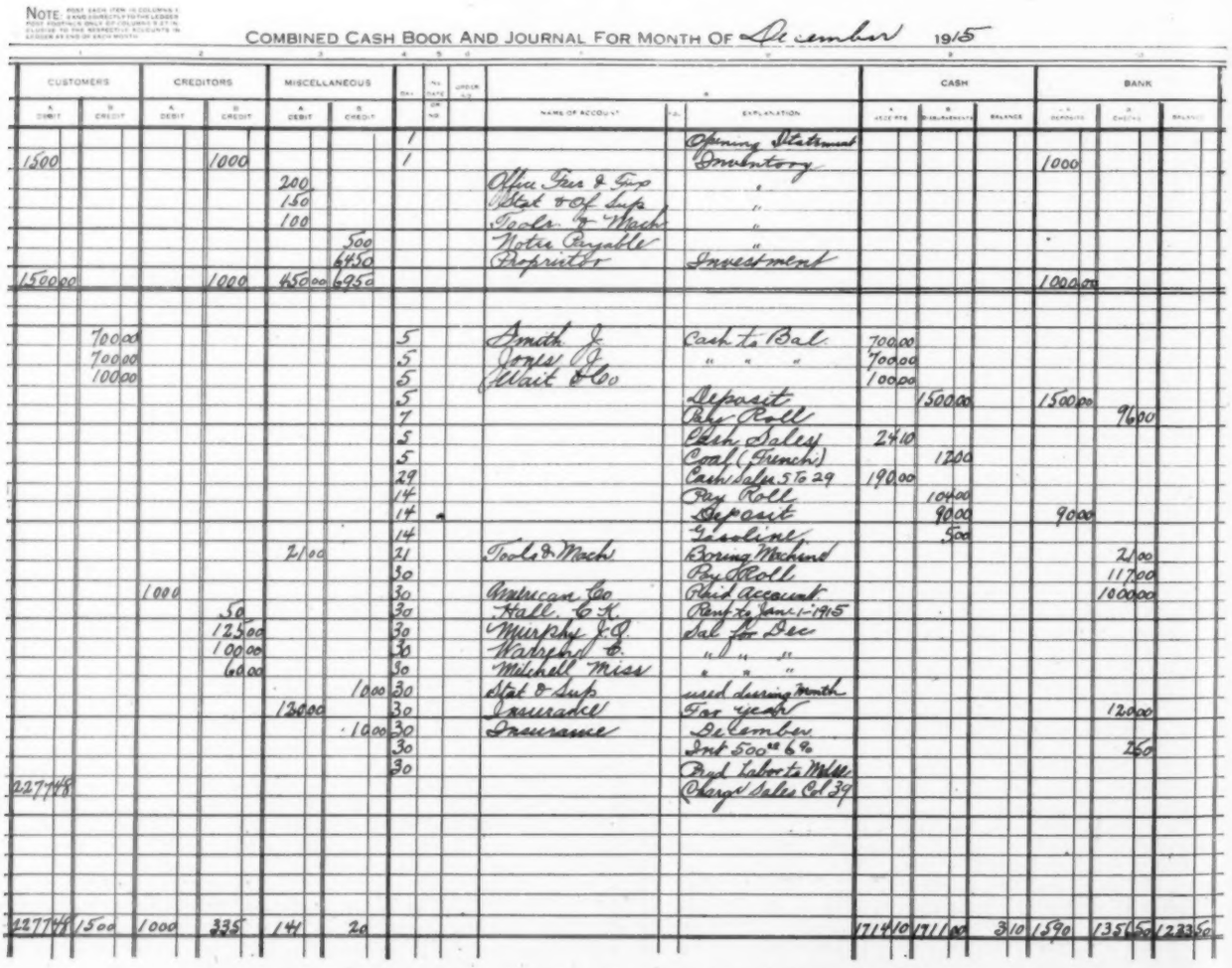
FEELING that there is an arousing of interest throughout the entire country in business efficiency, and knowing that there are almost countless good things being used by various persons in the prosecution of their business which, if brought to light and carefully studied, would benefit the whole business world, and believing that it is our duty to one another to lend all possible assistance in bringing about more favorable conditions, I am presenting at this time a matter which I hope will benefit some one or more of the readers of these remarks.

Need for Comprehensive Accounting System.

Account keeping is a very important matter in every business of any consequence. The income tax law which is already in force and other laws of similar nature which will no doubt be enacted have made it necessary to keep a much more comprehensive system of accounts than the very simple forms which in the past have done service for a large majority of business concerns. In addition to this the banks are becoming more strict in regard to statements required from their patrons, and jobbers and manufacturers are declining to extend credit without satisfactory evidence of the strength and business methods of their customers.

The successful business man of the future must keep in close touch with his business affairs in order to keep his business properly balanced, and to meet these needs he must install some comprehensive accounting system.

In previous articles I have attempted to expose the business fallacies of many electrical and mechanical contractors and many other business concerns, and advocated the co-operation of the various national organizations in an effort to produce better methods, with the assistance of our Federal Trade Commission, which has issued a cry of warning throughout the country, "Teach the business man to know his costs so that he may set an intelligent selling price." Co-operation in organizations of employers has proven worthy of permanency only as such co-operation has been pursued which has tended toward higher efficiency of workmanship with intelligent understanding of its costs. Thus has business been able to justify its position in regard to increased prices and in no other way will it endure the attacks of modern criticism.



NOTE: POST EACH ITEM IN COLUMNS 1 AND 2 DIRECTLY TO THE LEDGER POST TOTALS ONLY OF COLUMNS 3 TO 10 INCLUSIVE TO THE RESPECTIVE ACCOUNTS IN LEDGER AT END OF EACH MONTH.

COMBINED CASH BOOK AND JOURNAL FOR MONTH OF December 1915

CUSTOMERS A DEBIT	CUSTOMERS B CREDIT	CREDITORS A DEBIT	CREDITORS B CREDIT	MISCELLANEOUS A DEBIT	MISCELLANEOUS B CREDIT	DAY	NO. DATE OR NO.	LEDGER FOLIO	NAME OF ACCOUNT	EXPLANATION	CASH A RECEIPTS	CASH B DISBURSEMENTS	CASH BALANCE	BANK A DEPOSITS	BANK B CHECKS	BANK BALANCE
						1				Opening Statement						
1500			1000			1				Inventory				1000		
				200					Office Fees & Exp	"						
				150					Stat & Off Sup	"						
				100					Tools & Mach	"						
					500				Notes Payable	"						
					6450				Proprietor	Investment						
150000			1000	450 00	6950									100000		
	70000					5			Smith J	Cash to Bal	70000					
	70000					5			Jones J	" " "	70000					
	10000					5			Elliott & Co	" " "	10000					
						5				Deposit		150000		150000		
						7				Pay Roll					9600	
						5				Cash Sales	2410					
						5				Coal (Grunch)		1200				
						29				Cash Sales 5 to 29	19000					
						14				Pay Roll		10400				
						14				Deposit		9000		9000		
						14				Gasoline		500				
				2100		21			Tools & Mach	Boring Machine					2100	
						30				Pay Roll					11700	
		1000				30			American Tool	Bal Account					100000	
			50			30			Hall C K	Rent to June 1-1915						
			12500			30			Murphy J Q	Sal for Dec						
			10000			30			Walrath H C	" " "						
			6000			30			Mitchell Miss	" " "						
					1000	30			Stat & Sup	used during month						
				12000		30			Insurance	For year					12000	
					1000	30			Insurance	December						
						30				Int 500 at 6%					250	
						30				Bal Labor to Mdse						
227748										Charge Sales Ch 39						
227748	1500	1000	335	141	20						171410	171100	310	1590	135650	22350

Left-Hand Page of Combined Cash Book, Journal and Balance Sheet Form.

There are two kinds of office systems which have come under the writer's observation. The first is where the system serves as a constant guide to the business man, and the other is where the man must continually guide the system. The one is servant of the man, and the other is master of the man.

Must Have Concrete Knowledge of Actual Condition of Business.

In many instances where business men are operating with some form of records, there seems to be lacking a special form for the purpose of assembling the different accounts into one record, which may be examined for the purpose of securing some concrete knowledge of the actual condition of the business. Some form is needed which will contemplate all controlling accounts, and give the bookkeeper or manager an idea of the true condition of the business at a glance, and this in order to keep the business in proper balance.

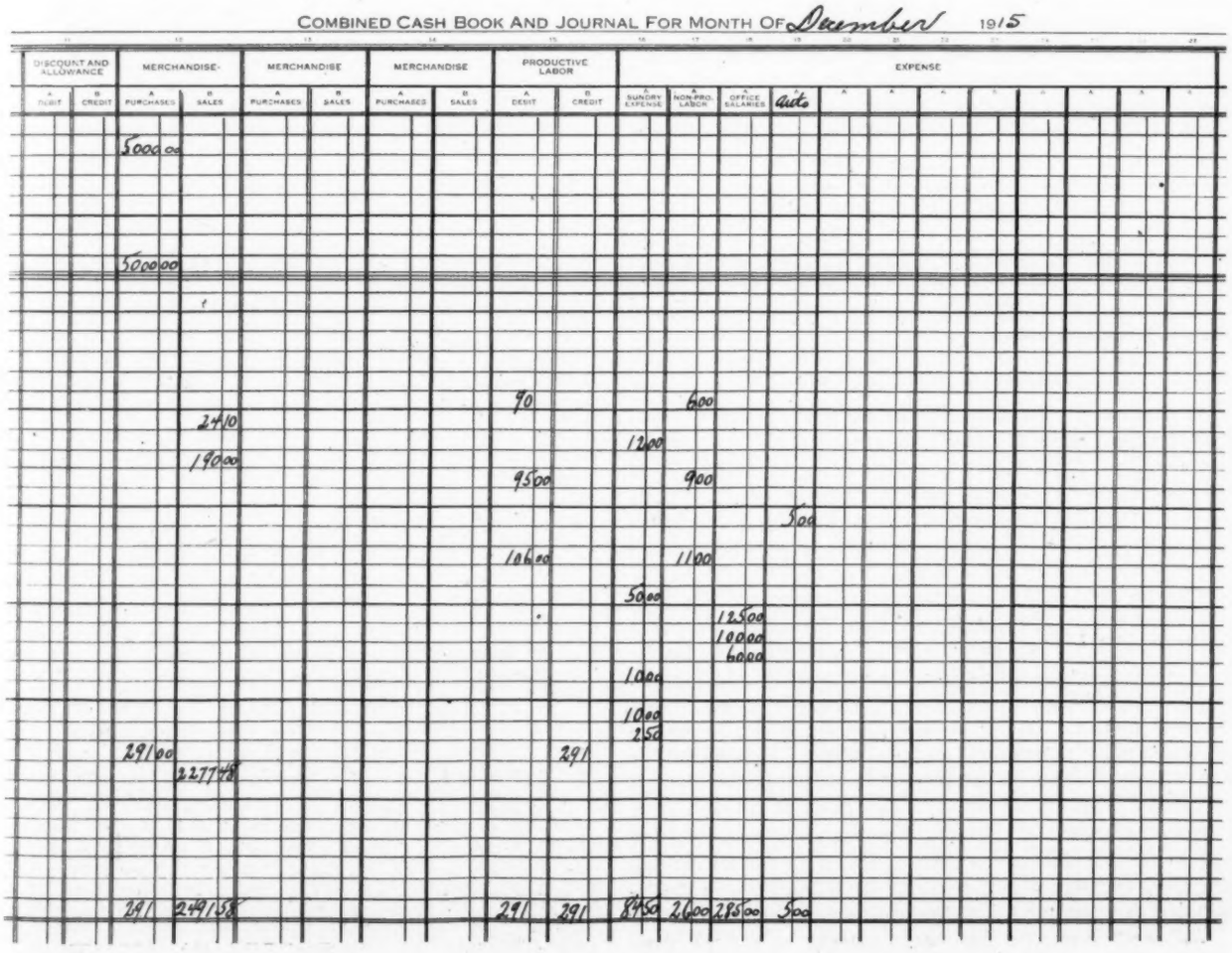
For instance, the Accounts Receivable account in any business may very easily, and without the knowledge of the manager, become out of all proper proportion to the amount of the investment. This is true in many business institutions, and is one very important reason why a large number of failures are recorded annually in this country. On the other hand, the Accounts Payable may become too large together with the steady tendency for the operating or overhead expense to increase. Added expense is a thing which seems to be in the very air. It is like the flies at the screened door of an eating house who are simply swarming there waiting for some one to come along and open the door so they may rush in, almost unnoticed, until the place is overrun with these pests.

And so it is with the overhead expense. It is waiting just outside for some opportunity to creep into the business, and if this is not watched carefully, the whole business is likely to be overrun with this profit-eating germ.

The two accounts just referred to are perhaps the most important in any business, yet there are others which have more or less bearing on the proper conduct of the business. There are any number of record-keeping systems in operation in which these accounts are no doubt kept correctly as far as the principles of bookkeeping are concerned, but many of them are not in such form as to present themselves at a moment's notice when a general survey of conditions is required.

Serious Difficulties Due to Lack of Convenient Balance Sheet.

It is nothing uncommon for certain business concerns to receive a very severe shock, when at the end of the year a financial statement of their affairs is presented to find that they have a tremendous amount tied up in outstanding accounts on their books, and then again to learn that they are owing hundreds and possibly thousands of dollars in excess of the amount which they anticipated. If it is found only once each year that the Accounts Receivable account is all out of proportion to the business, it is often too late. Many accounts which could have been collected, if given prompt attention, are now perhaps uncollectible and are lost, resulting in the necessity of charging them to the Profit and Loss account, which naturally affects the Overhead or Operating Expense account. It may increase this account entirely out of proportion to the amount of business done and places a decided handicap on the business, as compared with its more careful competitors, since the overhead



Right-Hand Page of the Same Combination Form.

or operating expense would be much less with the concern that has less bad accounts. Moreover, the concern which has kept its accounts collected up close has had the use of its money, turning it over several times each year at a profit, meaning a multiplicity of profits on the same money, while the other less careful concern has lost the interest on the money invested in outstanding accounts.

Discount and Allowance accounts are often bitter disappointments to many when they are not in close touch with this very important account continuously. Allowances and discounts are given to customers frequently, and for various reasons. Some are logically reasonable while many are not, but this goes on for a whole year, and this account is finally presented to the manager and it frequently staggers him. It is usually altogether too great, yet it has passed from time to time, and now at the end of the year it is too late to attempt to change conditions which have passed—and the only thing to be done is to charge the whole amount of allowance or discount given to the Profit and Loss account and unfortunately for many it must be entered on the loss side. Consequently this account very often affects the annual profits of the concern.

Discounts taken, form an item of vital importance to every concern. This is a very interesting account, for it shows the value of cash payments, or the purchasing power of cash. In any ordinary business where the Accounts-Receivable account is watched closely and where outstanding accounts are promptly collected, the manager is in a position to take advantage of some very decided bargains and enabled to secure many handsome discounts which are offered for cash. Besides this, the concern is not losing the interest on outstanding accounts of, say 6 per cent, and is very often buying at from 2 to 5 per cent better for cash than the concern that is compelled to buy on time on account of a shortage of ready money brought about often by the fact that the owner and manager are not in close touch with the controlling accounts of his business. In other words, he is depending altogether too much upon the chief bookkeeper and other heads of departments and has not his fingers on the pulse of his business in the effort to detect any undesirable condition which may creep in without any one being aware of it. Just as the deadly disease germs creep into our homes and destroy whole families, just so will these business-destroying germs, like excessive overhead, bad accounts, discount and allowance, creep into the business and destroy the whole concern.

Bad and Good Management.

There seems to be a disposition on the part of many to overlook the importance of paper record-keeping methods. Some managers have the idea that they are there simply to boss some one, and if they employ a bookkeeper and see that he comes to work at 8 a. m. and leaves at 5 p. m., that this is all that is necessary, so far as his supervision of the bookkeeping is concerned. I have heard many managers confess that "John the bookkeeper is a good one and when it comes to beekkeeping I'm out of it," or "We just depend upon him to keep the books and that's as much as I know about it." Again I have been invited to contractors' offices for the purpose of advising the managers whether I thought their bookkeepers were all right. It would seem that, if the manager had the proper conception of his duty as supervisor for the affairs of his concern, he would know whether his bookkeeper was a good one or a bad one.

Many managers seem to think that they are there to buy and sell, to see that their employees arrive on time and do not quit too early, and simply to give everybody connected with the institution to understand that they are running the whole affair.

The most successful business managers have been those broad-minded men who have stood rather in the light of teachers, who have gathered around them men of ability and have by their actions toward these men secured their friendship and hearty co-operation in a decided effort to continually improve conditions, and to study human development and efficiency from every angle, for man building always results in business building. These are the men who have been the greatest captains of industry in this country.

An executive may have a very fine plan of operating a business, the financial department may have ample funds, the factory or producing department may be thoughtfully equipped, and there may be plenty of men covering the territory as salesmen, but unless there is efficiency in every part of the business the results are unsatisfactory, and without proper instruments to record the actual conditions and results, such as a comprehensive bookkeeping system, we are unable to detect the inefficiency. Therefore the manager should be a teacher and leader of men, instead of a clerk driver, and he must carry this work to a point where the final records of all business transacted will reflect the efficiency of any department or individual.

The four-sided square of any business consists of the executive, the financial, the producing and the sales departments. All of these are greatly dependent upon each other. Inefficiency in any one department will lessen the area of the whole concern, and without the hearty co-operation of all there will be unsatisfactory results. Many managers know from ultimate results that there is something wrong, but they have not their records in such shape as to detect the exact nature of any unfavorable conditions or its source. There may be a weakness somewhere in any one of the four departments, but to be able to put one's finger on this weakness and to devise ways and means of eliminating it, requires certain records, certain information which should be at hand every day, and this, of course, must be a record-keeping system which shows at a glance the true condition of all controlling accounts in the business.

Combined Cash Book, Journal and Financial Statement.

I am therefore submitting herewith for your inspection a form which may be called a Combined Cash Book, Journal and Financial Statement. This particular form was designed to meet the requirements of at least 95 per cent of the electrical and mechanical contractors of the country, and while for some few establishments some changes might be found desirable yet the principle involved will meet the requirements of any business of any consequence whatever. Where this multi-column record has been employed it has given perfect satisfaction and is without a doubt to the business manager what the compass is to the sea captain. It guides his course.

Your attention is directed to the form recommended. You will observe that each of the various controlling accounts has a separate column on this sheet. These columns are numbered from 1 to 27. All debit columns are lettered A and all credit columns are lettered B. This is done in order that the operation of this system may be taught by means of a simple key.

For example, if a customer would pay an account of $10.00 the entry would be taught as follows: Enter in Column 7 the name of the customer, in Column 1B the amount $10.00 and the same amount in Column 9A. Meaning that cash had been charged with the amount and the customer given credit. It will be readily understood that the total of Column 1A would represent the outstanding accounts, or accounts charged to the customers, and Column 1B would represent the amount paid by the customers, and the difference between the two columns would represent the amount of outstanding accounts.

Column 2 represents the Accounts Payable or Creditor's account. Footing of Column 2B represents the amount we owe our creditors and 2A the amount paid to creditors. Column 9 represents petty cash receipts and disbursements. Column 10 shows the Bank account deposits and checks. Column 11 gives Discounts and Allowances. Columns 12, 13 and 14 are Merchandise accounts; three columns are provided for this purpose in order that the business may be divided into different

departments. Column 15 represents Productive Labor, and Columns 16 to 27, inclusive, are provided for segregated Overhead Expense.

A careful study of the form will show that it is practically a self-balancing system. Every entry in an A or debit column must have a corresponding entry in a B or credit column. It will be seen that every time an entry is made the books of the concern are balanced. This record eliminates the bugbear trial balance, which so many bookkeepers spend days to produce. The footings of all A columns should equal the footings of all B columns, and this can be done each evening in five minutes' time and the final page at the end of the month will be the trial balance.

The footing of all columns each day produces not only a trial balance but a financial statement. Suppose, for instance, that Column 1A was noticed to be increasing continually; it would be an indication that collections were not being pushed perhaps as hard as they should be. On the other hand, if we find our merchandise purchased columns increasing and our cash receipts and bank deposits increasing, we would conclude that we should push sales in order to have every dollar working. If we find that Column 11A is increasing we conclude that undue allowances are made to our customers. Column 11B shows the value of purchasing for cash and taking advantage of discounts.

These different columns will enable the manager to keep the different departments brushed up and keep the business operating at its utmost capacity.

Columns 16 to 27, inclusive, represent overhead expense. Suppose we were to add the footings of these Columns 16 to 27 together and compare this with the total cost of merchandise and productive labor, Columns 12 to 15, we at once arrive at our overhead percentage based upon the cost of productive labor and material. Suppose we added Column 15A (productive labor) to the footing of Column 12A (merchandise purchased), we have then the cost of productive labor and merchandise. If we then ascertain the material which went on our jobs at cost, we are in a position to at once produce a book inventory of merchandise. From the total of Column 12A, plus the amount of the last inventory, deduct the cost of merchandise sold and we have a book inventory.

This means that you have taken the amount of merchandise purchased during the month, and added it to what was on hand at the beginning of the month, and deducted from that total the amount sold during the month (at cost), leaving the amount on hand or the present merchandise inventory.

It will be observed from the above that by certain combinations any important information may be obtained almost at a glance, and some system of this kind should prove valuable to any contracting concern. It will require very little study on the part of the bookkeeper to be able to understand and operate the system and to make certain combinations which will produce wonderful results.

Taking the illustration written on the form herewith reproduced, we observe in Column 1A that our customers owe us $2,277.48 and that thus far they have paid us $1,500.00 as represented by the footing of Column 1B. The difference is our total accounts receivable. We find by reference to Column 9A that the cash receipts were $1,714.10 and the cash disbursements (Column 9B) were $1,711.00; we have a balance on hand of $3.10. We began business with $1,000.00 in the bank, as shown by Column 10A; this added to footing of Column 10A, minus Column 10B (checks) gives us our bank balance. Column 12A shows that the business was started with $5,000.00 worth of merchandise on hand. There was no merchandise purchased during the month, except in that productive labor is always considered like merchandise, as it is bought at one price and usually sold at another, so we carry over the amount in Column 15A to 12A and this then represents merchandise purchased. Column 12B represents merchandise sold, $2,491.58.

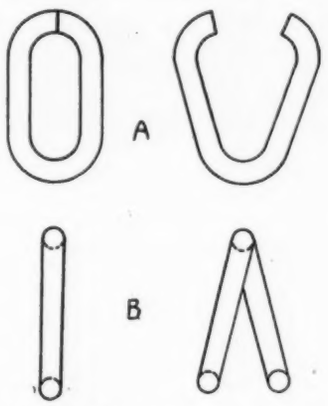
If we have kept a cost system, the amount of merchandise sold figured at cost, deducted from the inventory plus the purchases will produce a book inventory which, if properly kept, will answer every purpose of an inventory and may prove valuable in case of fire where the accounts are saved. Ten minutes is all that is necessary to produce a book inventory, a trial balance or a financial statement, and these are the things which the writer contends should be produced in every business every 30 days.

Adjusting the Length of Fixture Chain.

By H. L. Baer.

I have noticed many electricians open (and close) links of fixture chain as shown in sketch *A*. With this method it is practically impossible to close the ends of the link tightly together. This will not make a neat job to the eye of the person mechanically inclined.

The method shown in sketch *B* is the proper way. In this case the ends of the link are twisted out of the plane. By this method it is possible to have a spring tension where the ends meet and they can be brought snug together.



Wrong Way (A) and Right Way (B) to Open Chain Links.

Among the Contractors.

F. E. Newbury Company, of Los Angeles, Cal., was awarded the contracts for ornamental light installation on State Street, Santa Barbara, Cal.

The Montezuma Manufacturing Company, Montezuma, Ga., has been awarded the contract for the installing of a white way in the business section of Montezuma.

J. L. Cannon, who has been in the employ of several electrical-contracting companies, has recently started in business for himself and has opened offices at 247 West Main Street, Charlottesville, Va.

The McKeever Electric Company, Columbus, O., has been awarded the contract for the wiring of the new Citizens Bank Building, in Columbus. Four-in-One fixtures will be installed. Other recent contracts secured by this company are: Wiring of court house and postoffice, at Huntington, W. Va.; electrical work on court house, at Eaton, O., and the high school, at Gallipolis, O.

The Electric Wiring & Fixture Company, Toronto, Ont., Canada, entered into an advertising campaign in local newspapers stating in each advertisement that it would accept contracts for wiring houses at about cost during its slack months of January and February. This, it was stated, would be done in occupied houses without breaking the plaster or marking the wall decorations and at the same time all wires would be concealed. The result of the campaign during January showed that more work was undertaken than during the same month of any of the past 18 years.

VIEWS AND COMMENTS

A Reader's Page Wherein Opinions on Topics of General Interest to the Electrical Industry May Be Expressed

Suggestion That Contractors Submit Statement of Quantities with Their Proposals.

To the Editor:

I have often wondered whether some plan could not be devised to require the bidder to submit a list or quantity estimate with his bid, so that the architect or owner could compare them and find out if the bidder has forgotten anything. Under our present method of getting bids it seems that the bidder who left out some item usually gets the job and then gets out of his difficulty the best way he can and it is usually presumed that he takes out of the job all it will stand, without being found out. Obviously this must work injury to the trade in general and since the question of educating all the bidders is impossible on account of the rapidly growing crop of bidders (there is an annual vintage of about four right in this little town) it would seem that to make a man "show his hand" in submitting a bid much of this error might be eliminated.

I can see how radical a departure for the architect it is to go into so much detail as to prepare a quantity statement himself, when he is accustomed to having his stenographer thrash out one or two pages of the same copy for five years and use the same specification for a cottage as for a five-story office building. But the writer actually had an architect ask for a detailed list of material to be used to be submitted with the bid on a recent job and the idea struck us rather as novel and capable of development into some sort of intelligent method of finding out whether or not the bidder knows or realizes the chances he takes when he puts in his bid on a job and assumes the risks of error.

Rochester, Minn. Ed. M. Raetz,
Member of Firm, Foster-Raetz Electric Company.

Methods of Wiring Three-Way Switches.

To the Editor:

The several articles* which have recently appeared in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN on control by means of three-way switches are of particular interest in that they show, in some cases, that simpler wiring, lower installation cost and provision for future extension may be secured by the use of a certain system of connections.

The two systems in use are commonly known as the "standard" and the "Carter." They are illustrated below for control at two positions. Both systems may be extended with control at additional positions and other combinations, including master switches and burglar-chaser connections, may also be employed.

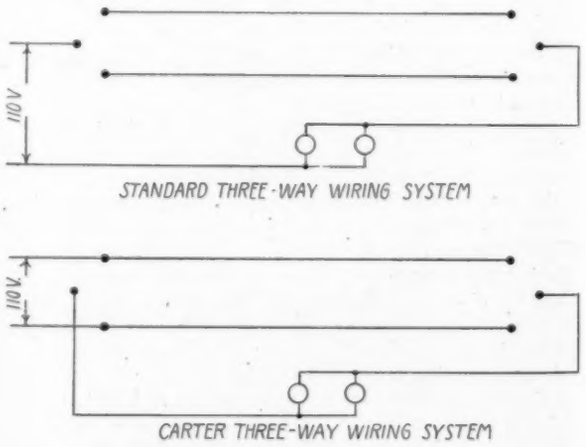
There appears to be a difference of opinion as to whether the Carter arrangement is acceptable to inspection departments. Formerly this system was not allowed. The requirement as stated was that three-way switches must be so wired that only one pole of the circuit should be carried to either switch.

However, no such limitation appears at present in the National Electrical Code nor in the List of Approved Appliances. Both the standard and the Carter systems are permitted by the inspection department of the City of Chicago. The present edition of the Code simply states that "three-way switches are considered as single-pole switches." They do not cut off all connection as double-pole switches do. Their operation is single-pole, even when they are connected to both poles. Their limitations are those of the ordinary two-point single-pole switches, the principal limitation being that they must not be used to control a load of more than 660 watts.

There are no accepted considerations, such as insulation or other constructional details, which, under the Code, should limit any of the approved three-way or four-way switches to the standard connection. Of course, with both poles brought into a Carter-connected switch and in the event of the switch being out of repair, a short-circuit may occur in the switch, but this might also happen with any double-pole switch. Also, it is perhaps the better practice to connect single-pole switches in the ungrounded, or "live," leg of grounded systems for the reason that the opening of the switch with such connection will cut off potential from the major portion of the circuit. This refinement may be applied to the standard system but not to the Carter. However, it is not required by inspectors and is seldom adopted by wiremen. Further, the Carter system cannot be used where conditions of operation require that the polarity shall not be reversed on the load.

In Chicago, the department requires for all services entering garages that an indicating service switch must be installed which will cut off each wire. This service switch has not appeared in the garage circuits heretofore published in the articles referred to. The need for such a service switch has arisen from the serious life hazard to which firemen attempting to put out a fire in a garage have been subjected where this switch was not provided. Where the service to the garage comes from a residence or other building adjoining the garage, separate service fuses are not required in the garage, since the fuses of the house circuit supplying the garage furnish the protection necessary.

For loads of more than 660 watts, an arrangement for double-pole control from two positions by means of knife switches appeared in the last issue. The connections shown are essentially a development of the standard single-pole system. The design of a corresponding standard arrangement for three positions and also the corresponding Carter two and three-position double-pole connections (if possible) might be interesting exercises for some of the readers of the REVIEW.



Two Methods of Wiring Three-Way Switches.

Chicago, Ill. L. L. Johnson,
Electrical Inspector in Charge of Laboratory, Bureau of Electrical Inspection, City of Chicago.

*January 20, 1917, page 117; February 17, 1917, page 287.

NEW APPLIANCES

A Review of the Latest Developments and Information Respecting Electrical and Kindred Mechanical Appliances

New Method of Lighting Bank Cages.

The lighting of banks and other institutions that have financial dealings with the public has been given a great deal of study, particulary so the lighting of the individual windows and cages at and in which the tellers work. This work is of an exacting character, and it has been found that poor lighting results not only in eye-strain and consequent inefficiency on the part of the tellers or clerks, but is the unquestioned cause of many errors that involve large sums. For this reason the subject has been given the most careful consideration and various methods of lighting the working surfaces within the cage have been developed.

A new method of accomplishing this is the result of special study, and is a decided improvement over the old type of continuous reflector trough which has had considerable vogue. A general idea of this method of illumination can be gained from Fig. 1, which shows the interior of a typical bank cage, in which four of the new style troughs can be seen. It will be observed that the entire lower surface of the troughs is uniformly luminous. This surface is composed of a carefully selected special type of opal diffusing glass, which gives uniform luminosity without high brilliance. In Fig. 2 is shown one of these troughs with part of the bottom glass panel removed. A section through one of the troughs is shown in Fig. 3. It will be observed in these two latter illustrations that a group of four lamps constitutes the lighting equipment of each trough. These lamps may be either 10, 15 or 20-watt tungsten units, depending upon the height of the trough above the working plane and the amount of illumination desired.

Fig. 1.—General View of Bank Cage with New Type Lighting Troughs.

Each lamp has over it a silvered-mirror-glass reflector, thus throwing all of the light downward into useful directions. The reflector is so shaped as to distribute the light uniformly over the counter surface within the cage.

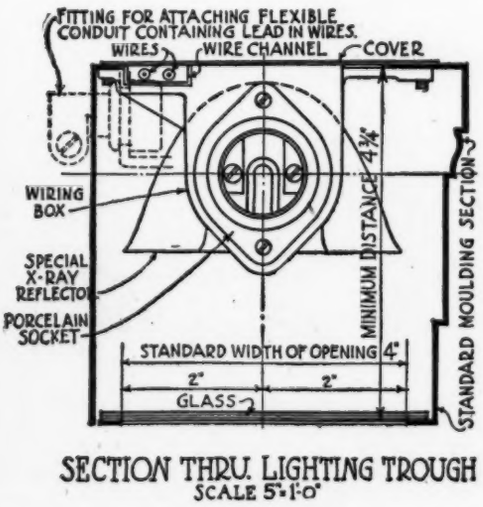
This method of lighting has a number of advantages. It is much more efficient than any methods as yet employed, since lamps as low as 10 watts may be used in place of the former custom of employing 25 or 40-watt lamps. Even with 10-watt lamps an illumination of about five foot-candles is easily secured on the surface of the desk, and this intensity has been found ample for the closest work performed in the usual bank cage. The absence of glare

VIEW OF X-RAY BANK CAGE LIGHTING TROUGH, FROM BELOW, WITH ONE GLASS PANEL REMOVED.

Fig. 2.—View from Below.

and the uniformity of the illumination have already been alluded to. These lighting troughs can have any exterior finish to harmonize entirely with the material and finish of the bank screen, so as to form an integral part thereof.

This method of lighting can also be used for the usual double sloping desks commonly used by bookkeepers and bank clerks. In this case a trough is mounted over the middle of the desk, and serves to illuminate efficiently and uniformly both sides of the desk. Every part of the mechanism and wiring of the trough can readily be reached in case of trouble. The entire equipment has been approved by the National Board of Fire Underwriters. It is manufactured by the National X-Ray Reflector Company, 235 West Jackson Boulevard, Chicago, Ill.



SECTION THRU. LIGHTING TROUGH
SCALE 5"-1'-0"

Fig. 3.—Section.

Latest Type of Electrical Timepieces Installed by Telephone Company.

An electrical master clock controlling several position clocks, which embody some recently devised improvements, has been installed at one of the larger Boston suburban

exchanges by the New England Telephone & Telegraph Company. It is likely that other offices of the company will be similarly equipped.

The master clock is located near the chief operator's desk, and from it wires are run to keys mounted on turning sections and positions close by, with which are associated relays and various other pieces of apparatus. The keys are designated as emergency master-relay keys; they control central key groups, each of the latter controlling five position clocks mounted in alternating keyboards at a position directly back of the calling-circuit keys. Emergency keys and master keys are used in case of local trouble on the position clocks.

The mechanism of the master clock closes a contact every six seconds and in turn electrically operates the position clocks, which indicate the time in hours, minutes and tenths of minutes by hands clearly moved at six-second intervals. This method has a great advantage over an ordinary timepiece dial, as it insures accuracy in noting the time of calls.

Associated with the master-clock set are emergency keys, which are so wired that the master-clock set can be connected and the trunk apparatus disconnected from the trunk line over which emergency impulses may be received when needed. In case of failure of the master clock, in this particular exchange, it would be necessary to have the trunk line cleared of any connection which may be on it at the time, the emergency key thrown at the neighboring exchange, together with two master-clock set keys thrown at the home office, and thus impulses and commercial working conditions would be maintained.

Large Installation of Fixtures in Department Store to Give Daylight Effect.

With the advance in merchandising methods, particularly in large stores, there has arisen an increasing call for providing lamps of daylight quality for such departments where the color of textile fabrics must be accurately matched. A noteworthy installation of this character on a large scale has recently been completed in the department store of Mandel Brothers, Chicago, where the entire eighth floor of the State Street building has been equipped with Ohmlite fixtures made by the Moran & Hastings Manufacturing Company, 16 West Washington Street, Chicago. This type of fixture was described in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of October 7, 1916, and consists essentially of a set of panes of special opal glass that are set obliquely in such a manner as to resemble the blades of a turbine wheel, except that the panes are wider at the top than at the bottom and therefore give a conical but not displeasing appearance to the entire fixture. These fixtures are particularly designed for use with gas-filled tungsten lamps. They have a clear open space between the glass panes which permits exceptional ventilation and makes the fixture especially adapted for these lamps that require good ventilation. The panes are so arranged that no portion of the filament is visible. The glass used in the fixture has been carefully selected so as to reduce or absorb the excess of red and similar rays in the spectrum of the tungsten lamp and thereby give a light that is a very close approach to daylight.

In the installation in Mandel Brothers' store, it was this daylight quality of these fixtures that was an important element in their selection. The fixtures formerly installed consisted of large opal reflectors in which were tungsten lamps that were found to be objectionable both to the clerks and patrons of the store. On looking up through the large open bottom of the former fixtures the bare lamps were clearly visible and caused much annoying glare. Before deciding on a new type of fixture to use, numerous tests were made as a result of which the fixture referred to above was installed throughout the eighth floor, which is a department dealing with curtains, portieres and other tapestry goods. In order to permit a more careful color selection of the high-quality tapestries on sale it was determined to select a fixture that would give as near daylight as possible.

The installation consists of 46 fixtures, one placed in the center of each bay. These bays are 21 feet 6 inches square. The height of the ceiling is 12 feet and the fixture is suspended so that its center is 8 feet 6 inches above the floor. Each fixture contains a 200-watt type C Mazda lamp. Since the installation was completed a few weeks ago the lighting has been found to be very decidedly improved. The manager of the department is well pleased, as are the sales persons and patrons. In the accompanying illustrations is given an inadequate idea of the general uniformity and pleasing value of the illumination resulting, which has been found especially suited for the requirements of this department.

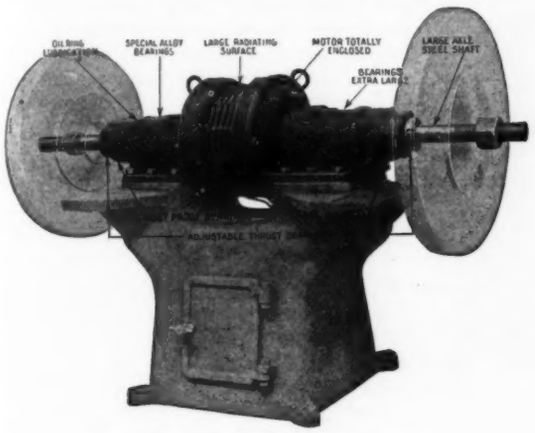
Two Views in the Curtain and Tapestry Department of Mandel Brothers' Store Illuminated by Ohmlite Fixture.

Westinghouse Alternating-Current Grinder Motor.

The grinder motor shown has been recently placed on the market by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. It is designed for use on two and three-phase, 60-cycle circuits and is constructed

especially to meet the severe conditions to which such motors are subjected in grinding and polishing work. This grinder motor is obtainable in three sizes, having capacities of 5, 7.5 and 10 horsepower, respectively. The 7.5 and 10-horsepower two-phase motors are supplied with autostarters. For the five-horsepower two and three-phase motors an ordinary knife switch is employed, and a special starting switch for the 7.5 two and three-phase motors. Pedestal bases, grinding wheels, and tool rests are furnished by the tool manufacturer.

To protect all parts against wear and injury from grit and metallic dust, the bearings are made dustproof, and the motor is wholly inclosed. Large radiating surface is



Alternating-Current Grinder Motor.

provided, however. The end brackets are solid and are cast integral with the feet, which are extra heavy and arranged so that they can be bolted rigidly to the pedestal.

The heavy grinding wheels, with which these motors are designed to be used, put a great strain on the shaft and bearings. These parts are, therefore, made extremely strong and rugged. The shaft, which is made of axle steel, is of extra large diameter, and is extended at both ends to receive the grinding wheels. The bearings, which are the only wearing parts on the whole motor, have very large bearing surface, insuring long life. Each is thoroughly lubricated by two oil rings. The end thrust is taken up by adjustable collars.

The rotor of the motor, which is of the squirrel-cage form, cannot be damaged. There are no moving contacts. The rotor bars are firmly fastened in the iron core and are short-circuited by end rings. No bolts or screws are used, and there is nothing about the rotor that can work loose even under the most severe service, or that will deteriorate under heat. The stator winding is thoroughly treated with an oil and moisture-resisting varnish. In motors larger than five horsepower the winding consists of coils wound on forms and completely insulated, then laid in the open stator slots and securely held in place by means of wedges.

Lubrication for Pneumatic Switch Cylinders.

Very often a piece of apparatus becomes defective, simply because of faulty lubrication. The operator has no means of knowing what the proper lubrication is, and in many cases the manufacturer does not go to the trouble to tell him.

To insure the proper operation of pneumatically operated unit-switch cylinders for electric-railway control, the Westinghouse Electric & Manufacturing Company has brought out a lubricant particularly suitable for this purpose, known as HL oil. It is furnished in two grades, of which No. 1 is a heavy oil for use during heavy overhauls, such as when switches are removed from cylinders. The cylinder and switches should be coated well, approximately one-eighth ounce being required for each cylinder.

For general lubrication the No. 2 grade is used. This oil is sufficiently liquid to permit of its being used in an ordinary oil can, and is applied without disassembling the switch group, by injecting in the hole in the top of each switch cylinder casing, about one-fourth ounce (two teaspoonsful) every 10,000 miles traveled by the car under ordinary operating conditions. If this does not produce sufficient results the oil should be used more frequently, but only the minimum amount applied that will give free operation.

New Lighting Unit of the Semi-Direct Type.

The pleasing effects and good illumination obtainable with the semi-direct type of lighting units are bringing about the development of new designs of this character, of which the one illustrated herewith possesses some unique features. It is known by the trade name "Nyelco Star" and is manufactured by the New York Electric Lamp Company, Incorporated, 38 Park Row, New York City. This unit is particularly adapted for the use of gas-filled tungsten lamps, with which it makes a very satisfactory combination of efficient reflection and diffused transmission.

The glassware used is a special type of diffusing cast opal glass which gives a pleasing pearly white appearance when illuminated. The upper reflector is made of a very dense white glass which reflects most of the light in downward directions. Enough light, however, is transmitted through this reflector so as to illuminate the ceiling to a sufficient degree to prevent the usual gloomy effect noticeable where opaque reflectors are used. The lower glass is used chiefly to diffuse the strong direct rays from the lamp filament. A considerable portion of the light, however, is reflected by the inner surface of this lower glass

New Semi-Direct Lighting Unit.

bowl so as to be directed against the upper reflector and then downward and outward. This unit can, therefore, be used for lighting quite a large floor area to a uniform illumination intensity by means of a relatively small lamp. This fixture can be mounted in various ways, such as by means of a chain or stiff stem or with a short ceiling holder. The fixture can be used in stores, offices, schools, public buildings and in other places where an efficient and pleasing fixture is desired. A considerable number of these fixtures have already been installed in stores, offices, restaurants, barber shops, dentists' offices, etc.

ACTIVITIES IN THE TRADE

General Electric Company is building a four-story, reinforced-concrete addition, 135 by 193 feet, to the plant of its Edison Lamp Works, Harrison, N. J. It will cost about $300,000. The company will also build a three-story addition to its plant in the East Orange section, 93 by 152 feet, to cost $100,000.

Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has just issued the 1917 edition of its Catalog 8-A. The catalog takes up a very complete line of fans and gives details and prices together with good illustrations of each style. Other interesting information regarding electric fans in general is given. This includes information on how the air from the fan circulates and how the fan should be placed so as to obtain the best results.

Lindsley Brothers Company, Edison Building, Chicago, Ill., producers of Western Red Cedar poles, is finding its monthly "cheer-ogram" of great value in spreading the gospel of "Good Poles Quick." The medium referred to is termed "The Pole Cat," and is published in the form of a miniature newspaper imprinted on a blotter. Considerable space is occupied by news items and information concerning the company service department and facilities.

McGill Manufacturing Company, Valparaiso, Ind., began the new year with a new idea and are now issuing *McGill's Magazine*. The first issue was published in January. In this issue there is an announcement of the inauguration of the publication by J. H. McGill. In this announcement he states that it is not the policy of the magazine to talk shop and the company's products to the exclusion of all else, but rather to discuss and talk of those things which we talk over during personal calls and which always lead to better relations. In the February issue there is a description of a lamp guard as made by this company and also a brief on Crescent Chatterton Compound, a Para rubber insulating material which the company manufactures.

The J. G. White Engineering Company, New York, has been awarded the contract for the engineering and construction work involved in the erection and installation of a new steam power plant for the Virginia-Western Power Company of Clifton Forge, Va. This new steam station will be located at Ronceverte, W. Va., and will have an initial installation of 5,000 kilowatts with provision for an ultimate capacity of approximately 30,000 kilowatts. The construction of a short transmission line will connect this new station with the existing transmission lines of the Virginia-Western Power Company, which company is now operating 114 miles of transmission lines in the territory between Lexington, Va. and Hinton, W. Va.

Annual Meeting of Domestic Engineering Company, Dayton, O., was held on February 14, the following directors being elected: E. A. Deeds, C. F. Kettering, R. H. Grant, B. F. McCann and R. D. Funkhouser. Mr. Deeds was re-elected president, C. F. Kettering, vice-president, R. D. Funkhouser, secretary and treasurer, and R. H. Grant, general manager. The reports laid before the meeting indicated that 10,000 "Delco" lighting systems were sold during 1916, and plans are being laid to sell 50,000 during the current year. The company will move into its new plant at Moraine City by early summer. The company now has about 1,200 sales representatives, in all parts of the world, General Manager Grant leaving immediately after the meeting for Havana, Cuba, where he will preside at a sales meeting.

Moloney Electric Company, St. Louis, Mo., has made arrangements with P. H. Affolter and A. E. Garland to represent the company on the Pacific coast. They will handle the company's transformers and be located in the Rialto Building, San Francisco, Cal. Both have formerly been connected with Fairbanks, Morse & Company. In further acknowledgment of the company's progressive policy it is noted that an addition to its plant has recently been completed. This addition makes the new plant twice as large as the old one. In addition to this the company has another factory at St. Louis which contains three times as much floor space as the old factory. In all, the present floor space occupied for the exclusive manufacture of transformers, amounts to 128,000 square feet. During the past year the company extended its business and states that today receipts are 10 times those of the previous year. Extensive progress in foreign trade has been made.

W. S. Barstow & Company, Inc., 50 Pine Street, New York, N. Y., has issued a very attractive brochure entitled "The Puzzle of Prosperity and Its Solution." It is aptly stated in the introduction that manufacturers the country over are today confronted with the question of how to increase production so as to keep pace with the growing demand for manufactured products. Individual executives and their subordinates find themselves taxed to the limit of their strength to keep the business going. Materials and labor are constantly advancing in cost and increased productiveness is the only hope of maintaining profits. Each industrial property has its own problem, and each calls for the expert services of an engineering organization rather than an individual engineer, it is stated. The booklet includes handsome illustrations of a large number of important projects for which the Barstow organization acted as constructing engineers, these including many of the public utility properties comprising the subsidiaries of the General Gas & Electric Company, under Barstow management.

Electric Machinery Company, Minneapolis, Minn., has just issued its Bulletin No. 175. It deals with a vertical type of alternator which is directly connected with the water wheel and is particularly adapted for hydroelectric plants using a low hydraulic head. The bulletin has been entitled "Bank Your Water Power" because in the contents it is shown how many hydroelectric plants are loosing power, and thus money, through inefficient equipment and equipment not particularly adapted to the plant where it is being used. In the first pages, where the equipment which should be included in the plant are discussed, a discussion on the use of a number of water-wheel units connected by a chain of gears to a horizontal generator is included. Illustrations and discussion of the vertical, direct-connected alternator are then given and followed by a very complete and detailed description of vertical alternators as designed by this company. The views reproduced in connection with this part of the contents show plant installations and separate illustrations are reproduced of each separate part of the vertical alternator, thus bringing out the description in a very comprehensive manner. A very good comparison is made between fuel power and water power in which the advantages and limitations of each are brought out. A sectional view, with description, shows a typical installation of a direct-connected, vertical alternator and in the concluding pages two charts are reproduced. The first shows the range of sizes and speeds of 60-cycle, vertical alternators and the second a typical test showing the percentage of power lost in transmission of power from the water wheel to the alternator.

PERSONAL AND BIOGRAPHICAL

MR. JAMES MARTELL has taken charge of the electric lighting plant at Avoca, Wis., and Mr. Frank Fox remains as assistant engineer.

MR. CHARLES O. MURPHY has been appointed assistant general manager of the American Public Utilities Company, with offices at Grand Rapids, Mich.

MR. H. N. EASTMAN, of Portsmouth, N. H., took charge of the commercial department of the Rutland Railway, Light & Power Company, February 15.

MR. W. J. ROSE, general manager of the Alliance Gas & Power Company, Alliance, O., has been elected president of the recently formed Rotary Club of Alliance.

MR. WILLIAM H. BROWN, manager of the Red River Power Company, Grand Forks, N. D., was appointed chairman of a committee to find employment for members of the North Dakota Regiment.

MR. RALPH J. PATTERSON, of Waterville, Me., and general manager of the Waterville, Fairfield & Oakland Street Railway Company, has been giving a number of talks on the uses of electricity on the farm.

MR. C. W. JONES, secretary of the Trumbull Electric Manufacturing Company, Plainville, Conn., resigned February 1. Mr. Jones had been connected with this company for 12 years and was known to a large number of the electrical fraternity.

MR. B. T. GIFFORD has resigned as chief engineer of the American Public Utilities Company, Grand Rapids, Mich. He will open offices as a consulting engineer in the Grand Rapids Savings Bank Building. The vacancy will be filled by MR. L. B. ANDRUS, who was formerly chief engineer of the Indiana & Michigan Electric Company.

MR. CLIFFORD ARRICK, publicity manager of the Central Group of Bell Telephone Companies, has been appointed by President Wilson to the Quartermaster's Department, Officers' Reserve Corps, with the rank of major. Major Arrick served as paymaster during the war with Spain, and will probably be assigned to similar duties if called to service with the colors.

MR. JAMES E. DAVIDSON, vice-president and general manager of the Pacific Power & Light Company, Portland, Ore., has been appointed to an executive position with the Electric Bond & Share Company, of New York. Electric Bond & Share Company is the parent company of the American Power & Light Company, which controls the Pacific Power & Light Company and Portland Gas & Coke Company.

MR. JOHN A. HOEVELER, assistant chief engineer of the National X-Ray Reflector Company, Chicago, will on March 1 sever his connection with this organization and assume the position of deputy in charge of lighting, Industrial Commission of Wisconsin. Mr. Hoeveler is a graduate of the University of Wisconsin, where he completed the electrical course in 1911 and was granted the degree Electrical Engineer in 1914. For a year and a half after his graduation he was associated with the consulting engineering

John A. Hoeveler.

firm of Vaughn & Meyer, Milwaukee, Wis., being engaged particularly on problems of illuminating design. For the last four years he has been in charge of reflector and illumination design and new development work with the X-Ray company. The new position he takes with the Industrial Commission of Wisconsin is unique in that it is the first instance of a state industrial commission undertaking the regular inspection of lighting for factories and other places of employment and of public buildings throughout the state. Mr. Hoeveler has for some time been devoting himself to a study of the requirements of factory lighting and is therefore peculiarly fitted to take up this new work.

MR. DWIGHT D. MILLER has joined the staff of The Society for Electrical Development, for the particular purpose of further developing the various uses of electricity in the different industries. The work of the Society has grown to a point where it has become necessary to add another engineer to its staff engaged in this field. Mr. Miller is a graduate of Harvard University. He was for over 10 years with the Westinghouse Electric & Manufacturing Company as sales engineer. He has been sales manager and consulting engineer for two other firms handling electrical and mechanical apparatus. He is also a well known contributor to leading technical journals and his 20 years of experience in solving electrical problems fits him particularly for the work of the Society.

DR. MORTON GITHENS LLOYD, technical editor of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN since May 1, 1910, has returned to the Bureau of Standards, at Washington, D. C., in the capacity of associate engineer. His work will be concerned largely with those activities of the Bureau having to do with public utilities. Dr. Lloyd is a graduate of the University of Pennsylvania and pursued post-graduate studies at Harvard and the University of Berlin, Germany. He was appointed to the Bureau of Standards in 1902 and was associate physicist in charge of the section of magnetic testing when he resigned to accept the position of technical editor. Dr. Lloyd is a fellow of the American Institute of Electrical Engineers and has served on many committees. He is at present a vice-president of the Illuminating Engineering Society, representing the Chicago Section, and is also a member of the American Physical Society, American Association for the Advancement of Science, and other organizations.

GEN. GEORGE W. GOETHALS, until recently chief engineer of the Panama Canal and governor of the Canal Zone, has opened consulting engineering offices in the Wall Street Exchange Building, 43 Exchange Place, New York City. He has associated with himself a corps of experienced specialists and will engage in a general consulting practice in civil, electrical, mechanical and hydraulic engineering. Special attention will be given to examinations and reports on canals, harbors, dry docks, terminals, dams, water-power development, water supplies, purification of tropical waters, refrigeration, reinforced-concrete structures, organization, management and public utilities. General Goethals is a native of Brooklyn, where he was born in 1858. He was a student at the College of the City of New York from 1873 to 1876 and then entered the United States Military Academy at West Point, N. Y., from which he was graduated in 1880. He received rapid promotion in the military service of the country, serving chiefly in engineering positions. He was an instructor in civil and military engineering at West Point for several years. Subsequently he had charge of the construction of the Mussels Shoals Canal on the Tennessee River. He was chief of engineering during the Spanish-American war. On February 26, 1907, he was appointed chief engineer of the Panama Canal which position he held until he resigned last year. His long service on the Panama Canal work covered the period of the bulk of the construction ,as well as the first years of the actual operation of the canal which involved the very difficult problems due to the serious slides that temporarily interrupted canal operation. Since returning permanently to this country General Goethals was appointed by President Wilson as a member of the commission to study the operation of the so-called eight-hour law for railroad trainmen.

OBITUARY.

MR. FRANK WALSH, an electrical manufacturer of Victoria, B. C., recently died in Los Angeles, Cal., just before returning to his home in Victoria.

CAPTAIN RICHARD S. SATTERLEE, vice-president of the Habirshaw Wire Company, New York, died on Wednesday, February 14, from pneumonia, contracted during service as military inspector with his command in the National Guard, S. N. Y.

CURRENT ELECTRICAL NEWS

Weekly Record of Construction Activities

EASTERN STATES.

AUGUSTA, ME.—The Central Maine Power Company is endeavoring to obtain authority to purchase plants, rights, etc., and an act to this effect is now before the state legislature.

BIDDEFORD, ME.—Plans are being perfected for a 10,000-horsepower development on the Saco River near Union Falls, by the Clark Power Company, Dayton, Me., a subsidiary of the Pefferell Manufacturing Company.

VASSALBORO, ME.—An act has been brought up before the state legislature authorizing the Vassalboro, China and Windsor Light & Power Company to supply gas and electrical energy to the town of Albion.

MONTPELIER, VT.—Charles H. Thompson and associates have purchased the plant of the Granby Municipal Lighting Company at Granby, Vt., and have formed the Vermont and Quebec Power Company. Plans are being made to connect the Granby plant with one controlled by the same parties at Richford, Vt.

FALL RIVER, MASS.—The street-lights committee of this city has recently approved acts which call for the installation of some new street lights.

HOLYOKE, MASS.—After noting that many replacements were necessary at the electric light plant, John J. Kirkpatrick, manager of the gas and electric department, states that he would rather, instead of making these improvements, favor the construction of a new plant.

PAWTUCKET, R. I.—An act has been brought before the state legislature authorizing the Rhode Island Power & Transmission Company to extend its lines and exercise the right of eminent domain.

BRIDGEPORT, CONN.—The question has been brought before the Board of Apportionment to appropriate money for a new white-way system for East Main Street.

HARTFORD, CONN.—The Hartford Industrial Development Company has contracted for the erection of a new factory of brick, four stories, to be occupied by the Underwood Computing Machine Company. Electric power will be installed.

HARTFORD, CONN.—A merger is being planned which will combine the East Haddam Electric Light Company and the Colchester Electric Light Company under the name of the former company.

TRUMBULL, CONN.—The Danbury & Bethel Street Railway Company and the United Illuminating Company of New Haven and Bridgeport are seeking a charter to supply this town with electric lights. Citizens favor it.

ELMIRA, N. Y.—The report of Fred Bright, chairman of the lamp committee of the Common Council, has been accepted and a number of new lights are to be placed in this city besides the replacing of many old lights.

TOTTENVILLE, N. Y.—The Richmond Light & Railroad Company is considering the installation of a cable line from Linoleumville to Lake Island, over Fresh Kill Creek for power and light service.

BAYONNE, N. J.—The Public Service Electric Company, Newark, N. J., has acquired property at Broadway and Thirty-sixth Street as a site for a new three-story building to cost about $75,000.

GIBBSTON, N. J.—A committee has been appointed to secure ways and means to establish an electric-light plant.

JERSEY CITY, N. J.—The Public Service Company, Newark, N. J., has made application to the city commission for a 50-year franchise for an underground-conduit system on Jackson Avenue.

NEWARK, N. J.—The Common Council is arranging for the installation of electric-lighting fixtures in the new northeast wing of the city hospital. Neil J. Convery is architect.

PATERSON, N. J.—A movement has been started by merchants on Main Street which calls for the installation of better lights.

TRENTON, N. J.—The civics-affairs committee of the Chamber of Commerce is negotiating with the City Commission for improvements in the city street-lighting system, including plans for a white way. Chares F. Stout is chairman.

WEEHAWKEN, N. J.—The North Bergen Township Committee has adopted a resolution providing for the calling for bids for electric street-lighting for five years. The Public Service Electric Company, Newark, N. J., is furnishing service.

HEREFORD, PA.—W. H. Schubert, A. E. Ward and A. L. Hart are organizing an electric-light and power company to install and operate a system in Hereford and Washington Townships.

CATASAUQUA, PA.—A hearing has been given the act permitting this city to erect an electric-light plant.

PENN HAVEN, PA.—Engineers have been making estimates of costs for the extension of the line of the railway lines of the Lehigh Valley Railroad Company. These extensions will be of considerable magnitude and several power houses will be located along the new system.

PHILADELPHIA, PA.—Charles Christos will build a new power plant in connection with his textile mill, to be erected at Hunting Park Avenue and Stockley Street. Howard Webster is engineer.

PHILADELPHIA, PA.—The Pennsylvania Railroad is taking up the question of electrification of the Chestnut Hill Branch within this city. The work, which is progressing rapidly, will cost about $1,200,000.

SCRANTON, PA.—W. F. Shean, of the Leonard Hardware Company, is at the head of a movement started for interesting men of his section of the city to install better lights on the streets.

SEWELL, PA.—The Mantua Township Committee has instructed Clerk Chew to get an estimate of the costs of lights for the streets.

SUMMIT HILL, PA.—The borough council is planning for the installation of a new fire-alarm system throughout the town.

YORK HAVEN, PA.—The York Haven Water & Power Company is planning for the construction of a large dam across the Susquehanna River, between Lancaster and York counties, for power purposes. George B. Harris is president.

NEWARK, DEL.—The city council is panning for extensions and improvements in the electric-lighting plant and water system to cost about $15,000.

HYATTSVILLE, MD.—The mayor and common council of this city have granted the Potomac Electric Power Company of Washington, D. C., a 10-year franchise to use the streets and alleys of the town, to furnish light and power for the community. The council also entered into a contract with the company to furnish street lights for the town.

BLUEFIELD, W. VA.—West Virginia capitalists plan to build a trolley line from Bluefield westward through the Norfolk & Western coal fields, 50 miles. The line will cost $4,000,000.

BURLINGTON, N. C.—The Piedmont Railway & Electric Company is extending its light and power lines to Elon College and Gibbonville.

WARSAW, N. C.—The city is considering construction of an electric plant, sewer system and water works estimated to cost $30,000.

WALHALLA, S. C.—The Hetrick Hosiery Mills will install equipment for electric operation at its new branch mill, to be erected at a cost of about $35,000.

EATONTON, GA.—The Putnam Mills & Power Company has been sold to Mr. Pitts of Commerce, Ga., who will continue to operate the plant with a new company. Burke Floyd will be manager.

UNADILLA, GA.—In an election to decide whether or not Unadilla should have electric lights, the voting resulted in 75 votes for lights and 7 against. The city will not give a charter to private individuals.

NORTH CENTRAL STATES.

BELLEVILLE, O.—W. E. Guinsler, of Junction City, O., has secured a 10-year electric franchise for supplying this city. Howard Guinsler operates the plant which serves the town, and improvements are contemplated under the new franchise.

CLEVELAND, O.—Power interests that are preparing to build a plant in the West Virginia Coal fields and to sell current to Ohio cities, will receive a formal invitation from the city of Cleveland to bid on a contract to deliver power at the city limits.

SHREVE, O.—Mr. Ben George of Sheffield, Pa., who it is understood represents electric railway interests, has been in this city to obtain an option on the electric plant of the Citizens Electric Light, Power & Heating Company.

YOUNGSTOWN, O.—The Republic Iron & Steel Company has announced plans for the complete electrification of its finishing departments, by means of current to be produced at Haselton, where large quantities of furnace gas are produced, which will be used as fuel for the production of power to operate the dynamos.

BLOOMFIELD, IND.—The Indiana Power & Water Company has been authorized to issue $569,000 28-year bonds to buy power sites and construct light and power plants.

FORT WAYNE, IND.—Members of the board of works have granted the appeal for $90,000 to be expended in purchasing a 5,000-kilowatt turbine generator for the electric-light plant. The light department asks $178,000 for the coming year, to be expended in running underground conduits and other work.

MONGO, IND.—Five power plants for development of the water power of the Pigeon, Fawn and St. Joe Rivers in La Grange county will be built by the Farmers and Merchants Light & Power Company, a recently organized concern which is to have headquarters in Mongo.

GIBSON CITY, ILL.—The citizens of Gibson are determined to exhaust all means in their efforts to establish a municipal plant.

HAMILTON, ILL.—The building of an electric smelter has been announced. The structure will be of steel and glass and will represent an initial outlay of $16,000. The corporation will be known as the Refining & Reducing Company. Its president is C. H. Lord of Chicago.

SPRINGFIELD, ILL.—The Springfield and Carbondale Electric Railway Company was recently incorporated with a capital of $1,000,000. Address Frank H. Brown of Hillsboro, Ill.

TUSCOTA, ILL.—A committee has been appointed to plan ways and means to install ornamental lighting. Address L. R. McNeil, secretary of the Business Men's Association.

BALDWIN, MICH.—Grand Rapids and Muskegon capitalists are interested in the proposal for the erection of a dam on Pere Marquette River. V. W. Montgomery of Reed City, Mich., is known to have secured options on some of the land along the river.

CHEBOYGAN, MICH.—Gardner S. Williams, 134 South LaSalle Street, Chicago, has prepared plans for rebuilding the hydroelectric power plant owned by the Cheyboygan Electric Light & Power Company. Address F. B. Spencer, secretary.

OTISVILLE, MICH.—An effort is being made to obtain AuSable power in this village, not only for lighting purposes but also to furnish power for the gravel pits.

BLOOMINGTON, WIS.—Plans are being arranged for the enlarging of the electric-light plant here. W. B. Kellogg of the Glove Electric Company, Milwaukee, Wis.,

has been helping to arrange for some of the improvements.

FOND DU LAC, WIS.—Kelsey, Brewer & Company, has purchased the Eastern Wisconsin Railway & Light Company.

JUDA, WIS.—It is said that Charles Schwartzlow has completed details for the erection of a plant to supply electricity to this city.

OSHKOSH, WIS.—A committee has been appointed to secure ways and means to improve the electric-lighting system.

SEYMOUR, WIS.—S. D. Newell sold his electric plant to W. E. Daniels of Worthington, Ind., who will take immediate possession. The price paid was $10,000.

UNION GROVE, WIS.—The electric-light plant in this city was damaged on February 10 by an explosion. The loss is said to be $10,000.

WATERTOWN, WIS.—This division of the Wisconsin Gas & Electric Company is making an addition to its plant. The addition will consist of a new 2,000-horsepower, motor-generator set with switchboards and other equipment necessary for this substation.

BENSON, MINN.—Engineer W. E. Skinner, 714 Plymouth Building, Minneapolis, Minn., is preparing plans for changing the direct-current system to an alternating-current system.

TRACY, MINN.—John W. Shaffer, First National Soo-Line Buiding, Minneapolis, Minn., is preparing plans for a white way for this city.

CEDAR RAPIDS, IOWA.—In order to do away with smoke it is stated that the National Oats Company intends to electrify its plant and obtain power from the Iowa Railway & Light Company.

WATERLOO, IOWA.—Construction work has been started on the new power plant of the Citizens Gas & Electric Company. The steel work is about completed and brick work will be started March 1.

KANSAS CITY, MO.—A contract has been entered into by Wilson & Co., packers, with the Kansas side municipal light plant for the furnishing of electrical energy to its plant.

SPRINGFIELD, MO.—The Federal Light & Traction Company has purchased a site for the erection of a $250,000 substation. It will be used to relay the hydroelectric power now being supplied the Springfield Gas & Electric Company from the White River dam. The equipment contemplated includes a new turbine of 5,000 kilowatts capacity. A. F. Van Deinse, is general manager of the local company.

BALDWIN, KANS.—A mass meeting of the citizens was held to discuss plans for remodeling the municipal electric-light plant. A bond issue to the amount of $12,000 to $18,000 will need to be voted at the April election.

CIMARRON, KANS.—Cimarron is just about to close a deal with the Garden City Sugar Company, whereby it will build a transmission line from Garden City to Cimarron and supply the towns along the line.

HUTCHINSON, KANS.—The city is getting figures on the cost of an ornamental system of lighting with a view to installing it on the streets in the Ninth addition.

TOPEKA, KANS.—The Leavenworth and Topeka Railroad may be changed into an electric road. Address W. A. Austin at Leavenworth.

WEIR, KANS.—The Empire District Electric Company of Joplin, Mo., has connected its lines and is now furnishing power to this city. The old plant which was operated for 25 years is being dismantled.

SOUTH CENTRAL STATES.

BUTLER, KY.—C. E. Record will install an electric-light plant. It will consist of a 20-horsepower oil engine, 15-kilowatt generator, and sundry other materials.

CHAVIES, KY.—The Coneva Coal Corporation, Lee Congleton, manager, will install an isolated, steam-driven electric plant, and is in the market for a 125-kilowatt, belt-driven, generator, used or new.

CLAY, KY.—Messrs. Mitchell and Dunnigan contemplate constructing an electric transmission line from Clay to Dixon.

EDMONTON, KY.—This city is to have an electric plant. Contracts have been given for lights in residences and business houses.

MURRAY, KY.—The city has let the contract to W. E. King of Covington, Tenn., to install an electric-light plant. Address Xavier A. Kramer, Magnolia, Miss.

WALTON, KY.—The local electric-light plant, owned by E. L. Kelly, was destroyed by fire on February 17, with a loss of about $5,500. The plant will probably be rebuilt as soon as possible.

CUMBERLAND SPRINGS, TENN.—L. Motlin, of the Cumberland Springs Hotel, is interested in the construction of an electric-lighting plant.

BIRMINGHAM, ALA.—It has been ruled by the court that the city may issue $500,000 in bonds for a municipal electric plant, as authorized by an election one year ago. No decision has been made as to whether the old plant will be remodeled or a new one built.

BIRMINGHAM, ALA.—The Davis & Allcott Company, recently organized with a capital of $50,000, is planning for the erection of a knitting mill for hosiery. Equipment will be installed for electric operation of the plant.

WETUMPKA, ALA.—The Montgomery Light & Power Company, according to F. W. Lull, mayor, will furnish this city with electricity and considerable progress has been made as regards the constructing of electrically-operated plants at the prison here.

LOCKESBURG, ARK.—The Arkansas Light & Power Company has been granted a franchise for the furnishing of electricity to this city.

FREDERICK, OKLA.—March 20, the question of issuing $95,000 in bonds for water-works improvements and the purchase of a privately-owned electric plant will be submitted to vote.

LINDSAY, OKLA.—The city council passed an ordinance authorizing the issuance of $6,000 in bonds to improve the electric-light plant and water works. Address the mayor.

NORMAN, OKLA.—The Oklahoma Gas & Electric Company has purchased the electric lighting plant from the Norman Mill & Grain Company. It is stated that the company intends to run a transmission line from the plant in this city to the plant at El Reno. Mr. W. Porter Jones is manager.

OKLAHOMA CITY, OKLA.—The state contemplates installing a power plant in the State Capitol Building. M. L. Cunningham, State Highway Commissioner estimates the cost of the plant at $187,000.

RINGLING, OKLA.—Deed has been filed showing the transfer of the assets of the Waurika Ice, Light & Power Company to the Consumers' Light & Power Company of Ardmore. An announcement is expected shortly of further acquisitions in southern Oklahoma by the Consumers' company.

ATLANTA, TEX.—The Gulf Public Service Company will construct an electric-light and water works plant at Atlanta, Bloomberg, Queen City and Orange. The stockholders of the company are Edward S. Ellis of McAlester, Okla., J. C. Connelly of Port Arthur and O. C. Oden of Atlanta.

DATES AHEAD.

Wisconsin Electrical Association. Annual meeting, Hotel Pfister, Milwaukee, Wis., March 15-16. President, W. E. Haseltine, Ripon, Wis.

National Association of Electrical Inspectors. Biennial convention, New York, March 27-29. Chairman committee on arrangements, Alfred E. Braddell, Sprague Electric Co., New York City.

Tri-State Water and Light Association of the Carolinas and Georgia. Annual convention, Macon, Ga., April 17-19. Secretary, W. F. Steiglitz, Columbia, S. C.

Southwestern Electrical and Gas Association. Annual convention, Dallas, Tex., April 26-28. Secretary, H. S. Cooper, 405 Slaughter Building, Dallas, Tex.

National Fire Protection Association. Annual meeting, Washington, D. C., May 8-10. Secretary-treasurer, Franklin H. Wentworth, 87 Milk Street, Boston, Mass.

Arkansas Association of Public Utility Operators. Annual convention, Pine Bluff, May 16-18. Secretary-treasurer, R. B. Fowles, Pine Bluff Company, Pine Bluff, Ark.

Electrical Supply Jobbers' Associations. Semi-annual meeting, Homestead Hotel, Hot Springs, Va., May 22-24. Secretary, Franklin Overbagh, 411 South Clinton Street, Chicago, Ill.

National Electric Light Association. Iowa Section's annual convention, Des Moines, Iowa, May 24-25. Secretary, L. E. Caldwell, Iowa City, Iowa.

National Electric Light Association. Annual convention, Atlantic City, N. J., May 29-June 1. Secretary, T. C. Martin, 29 West Thirty-ninth Street, New York City.

American Institute of Electrical Engineers. Annual convention, Hot Springs, Va., June 26-29. Secretary, F. L. Hutchinson, 33 West Thirty-ninth Street, New York City.

WESTERN STATES.

KALISPELL, MONT.—The commissioners granted permission to W. B. McDonald, manager of the Northern Idaho and Montana Power Company, for the erection of a pole line for power transmission from Bigfork to Polson.

OSWEGO, MONT.—Bonds will be issued for the purpose of building a light and power plant.

POPLAR, MONT.—J. C. Caincross is promoting a combined lighting and heating system here for eastern interests.

COLORADO SPRINGS, COLO.—Information is being gathered with regard to an electric-lighting system on Pikes Peak Avenue.

HAXTUN, COLO.—At a meeting of the city council it was decided definitely to install a municipal electric-light and power plant and bonds for the same, to the amount of $15,000, were allowed.

OATMAN, ARIZ.—Arrangements are being made for the installation of a power plant at the property of the Banner Gold Mining & Milling Company.

PARKER, ARIZ.—The Southern Sierras company is building a transmission line into Parker for furnishing electrical power for irrigation. Lines are also being built into Yuma and a line contemplated into the Quartzsite country. A line is being built into Barstow which will probably be extended to Parker and a line run from Blythe Junction to Blythe and Quartzsite.

WICKENBURG, ARIZ.—Interests which have established the new custom concentrating plant in this city, are now considering the installation of an electric-light and power plant.

OGDEN, UTAH.—In preparation for construction work on 135 miles of high-tension transmission line between Salt Lake City and Grace, Idaho, the Phoenix Construction Company has established a large warehouse in this city as its base of supplies.

BOISE, IDAHO. — The appropriations committee of the House of Representatives has visited the Gen irrigation district for the purpose of investigating the merits of the bill introduced for an appropriation of $3,000 for a power plant for the generation of electricity for use in pumping water.

BONNERS FERRY, IDAHO.—C. H. Green, engineer, Spokane, Washington, has completed plans for a light and water system in this city.

BONNERS FERRY, IDAHO.—The Bonner Light & Water Company will install a pumping station this spring.

EDEN, WASH.—The Idaho Power Company has been granted an electric-light and power franchise for this city.

PORT ANGELES, WASH.—J. W. Reddon of Port Angeles has filed on 10,000 cubic inches of water a second for power purposes in the Ho River. It is in connection with the proposed Port Angeles & Grays Harbor Railway.

TACOMA, WASH.—Steps are being taken for increasing the capacity of the municipal power plant and a new auxiliary steam plant to cost $300,000 instead of a new hydroelectric plant to cost $3,000,000. Mr. Gronen is commissioner from the city council.

WAITSBURG, WASH.—District Manager Mott of the Pacific Power & Light Company announces that the line from Walla Walla to Waitsburg will be thoroughly overhauled.

BEND, ORE.—Kempster B. Miller states that improvements to the Bend Water, Light & Power Company plant will cost between $50,000 and $75,000.

MEDFORD, ORE.—Plans are under way for the formation of a co-operative community district to be bonded for the construction of an electric-power and irrigating system. The district includes 25,000 acres in Sams Valley and the estimated cost of the project is about $1,000,000.

SALEM, ORE.—The Portland Railway, Light & Power Company has recently commenced the construction of a new 60,000-volt electric power transmission line to Salem from the River Mill hydroelectric plant near Estacada. The new line will

cost $40,000 and will supply power to Salem and to the substation at Mill and Liberty Streets.

FILLMORE, CAL.—The Ventura County Power Company is planning to rebuild the entire power line within the city.

LOMPOC, CAL.—The Continental Securities Company, holding the controlling interest in the Lompoc Light & Power Company is endeavoring to affect the sale of that company's holdings to the Midland Counties Public Service Commission.

LOS ANGELES, CAL.—About $20,000 will be spent in overhauling the plant and $5,000 in rebuilding the street-lighting system of the San Diego Consolidated Gas & Electric Company.

OROVILLE, CAL.—An election to vote on the formation of a lighting district will be held February 28.

QUINCY, CAL.—The Indian Valley Railroad Company has granted right of way to the Great Western Power Company for the construction of an electric transmission line along the railroad's properties.

SALINAS, CAL.—C. F. Phillips has been authorized to go ahead with the estimates relating to the installation of the electrolier system.

SANTA BARBARA, CAL.—The Chamber of Commerce is considering the establishment of a municipal light and power plant in this city. If this cannot be secured it is the intention to work for a distributing system. This proposition will be an issue at the spring election.

SONORA, CAL.—An election will be soon held to vote on an underground, municipal lighting system which will be built at a cost of about $20,000.

VENTURA, CAL.—Clarence Chrisman has filed an application with the State Railroad Commission for approval of intention to secure from the city of Ventura a franchise to build an electric plant.

YREKA, CAL.—The California Oregon Power Company has closed a contract to extend a power line to the Hofelder ranch for the pumping plant of Hudson and Edmonds.

Foreign Trade Opportunities

[Addresses may be obtained from the Bureau of Foreign and Domestic Commerce, Washington, D. C., or its offices at Boston, New York, Atlanta, Chicago, St. Louis, New Orleans, Seattle and San Francisco. Write on separate sheet for each item and give file number.]

No. 23,769. ELECTRICAL APPLIANCES.—A society in Switzerland is in the market for laminated and drawn electrolytic-copper wire; insulating paper for copper conduits; oils for the manufacture of insulating material, and iron bands for exterior armature of electric cables, under lead, for subterranean conduits, 1.17, 1.56, 1.75 and 2.34 inches wide, and 0.011, 0.019, 0.031, 0.039 and 0.046 inch thick. Quotations should be made c. i. f. European port. Payment will be made by cash against documents. Correspondence may be in English. References.

No. 23,772. MOTORS AND ELECTRIC APPLIANCES.—A man in Spain wishes to secure an agency for the sale of motors and electrical appliances. Correspondence should be in Spanish. References.

No. 23760. MISCELLANEOUS ELECTRIC MACHINERY—A man in Spain desires to secure an agency for the sale of all kinds of machinery. Correspondence should be in Spanish. References.

NO. 23,672. MOTORS, DYNAMOS AND GENERAL APPLIANCES.—A man in Spain desires to secure an exclusive agency for the sale of electric motors and dynamos and electrical appliances in general. Correspondence may be in Spanish or French.

NO. 23,668. MISCELLANEOUS EQUIPMENT.—A man in Mexico desires to represent American manufacturers and exporters. He expects to visit the markets of South America. He mentions no particular line. Correspondence may be in English.

NO. 23,641. ELECTRIC WIRE.—A firm in Spain is desirous of securing an agency for the sale of electric wire and cable for telephone and telegraph installation and supplies for telephone lines and stations. The firm states that it has an order for about $160,000 worth of such equipment and wishes to receive quotations, terms, etc. Quotations should be made c. i. f. destination, including commission. Correspondence may be in English. References.

Proposals

UNDERGROUND CABLE.—Sealed bids are being received for furnishing underground cable required by the Department of Electricity, San Francisco, Cal.

ELECTRICAL WORK.—The city of Chicopee, Mass., will receive sealed bids on March 6 for the electrical work to be done in the new high-school building.

STEAM ELECTRIC PLANT.—The Board of Public Works, Seattle, Wash., is receiving bids for the construction of an additional unit to the city's steam-electric plant.

ELECTRIC FIXTURES.—The Board of Trustees of the Oxnard (Cal.) School District is receiving bids for furnishing and installing electric fixtures and lamps for the new grammar school building.

UNDERGROUND CABLE.—Sealed bids will be received March 27, for furnishing the city of Milwaukee, Wis., 12,000 feet of underground cable, delivered F. O. B. Milwaukee. Address, Louis M. Kotecki, Comptroller.

LAMP POSTS.—Sealed proposals will be received by the West Chicago Park Commissioners at their office in Union Park February 27, for 30 cast iron electric light lamp posts to be delivered at the Union Park, West Lake street and North Ashland avenue. Address Timothy Cruise, Secretary of the West Chicago Park Commissioners.

NAVY ELECTRICAL SUPPLIES.—Bids will be received by the Bureau of Accounts and Supplies, Navy Department, Washington, D. C., for supplies at th following naval stations: Brooklyn, N. Y., Schedule No. 742, 40,000 feet of interior-communication cable, 4,300 feet of galvanized-steel conduit, 21,000 feet of single-conductor wire, 20,000 feet of twin-conductor with 140 telephone jacks. Philadelphia, Pa., Schedule No. 742, 3,000 feet of galvanized-steel conduit, Schedule No. 741, miscellaneous nickel-chromium resistance wire. Boston, Mass., Schedule No. 742, 120,000 feet of insulated antenna wire.

LIGHTING SYSTEM.—The Board of Trustees of San Leandro, Cal., has called for bids on the proposed lighting system for East Fourteenth Street and Washington Avenue.

Financial Notes

The Narragansett Electric Company, Providence, R. I., has made application for the increasing of capital stock from the present limit of $10,000,000 up to $12,000,000. It is stated that it is possible that some extensions will be underaken.

A net increase of 11.6 per cent is shown in the earnings report of the Arkansas Valley Railway, Light and Power Company, Pueblo, Colo., for the year ended December 31, 1916, over the corresponding previous year. Comparative gross and net figures for the month and year are:

Month of December:	1916.	1915.	Inc.
Gross earn...	$116,188	$108,111	$8,077
Net earn.....	54,096	50,539	3,557
Year ended December 31:			
Gross earn..	$1,260,287	$1,171,628	$88,659
Net earn.....	564,762	505,824	58,938

The National Utilities Company, Wilmington, Del., is to be incorporated to acquire all the common stock of the National Properties Company, the National Gas, Electric Light & Power Company and the Jersey Central Traction Company. The new company will issue $3,000,000 six-per-cent, cumulative, preferred, stock, $4,000,000 common stock and $2,500,000 three-year six-per-cent notes securd by the purchased securities. The authorized capitalization of the new company will be $10,000,000 preferred stock, $10,000,000 common stock and $2,5000,000 of the three-year notes.

Puget Sound Traction, Light & Power Company, Seattle, Wash., reports gross earnings for November $731,630, increase $87,807; net after charges $113,964, increase $55,818. Gross for 12 months $8,018,193, increase $440,763; net $715,018, increase $68,435.

Plans for absorption by the Adirondack Electric Power Corporation of neighboring properties have been perfected. It is proposed that Adirondack shall buy the Schenectady Illuminating Company, Mohawk Gas Company, Schenectady Power Company and East Creek Electric Light & Power Company of Amsterdam. These companies include developed water powers of 29,600 horsepower, but are essentially retailers, while Adirondack, with water powers of 31,000 horsepower, is chiefly a wholesaler. The management proposes new issues of about $6,500,000 bonds and

WEEKLY COMPARISON OF CLOSING-BID PRICES OF SECURITIES OF LEADING ELECTRICAL COMPANIES.

Quotations furnished by F. M. Zeiler & Co., Rookery Bldg., Chicago.

	Div. Rate Per Cent	Bid Feb. 12	Bid Feb. 19
Public Utilities—			
Adirondack Electric Power of Glens Falls, common	....	23	23
Adirondack Electric Power of Glens Falls, preferred	6	83	82
American Gas & Electric of New York, common	10+extra	140	140
American Gas & Electric of New York, preferred	6	51	51
American Light & Traction of New York, common	....	362	356
American Light & Traction of New York, preferred	6	112	112
American Power & Light of New York, common	4	85	86
American Power & Light of New York, preferred	6	90	91
American Public Utilities of Grand Rapids, common	....	39	38
American Public Utilities of Grand Rapids, preferred	6	70	69
American Telephone & Telegraph of New York	....	124⅜	125½
American Water Works & Elec. of New York, common	....	10½	10½
American Water Works & Elec. of New York, particip	7	25	24
American Water Works & Elec. of New York, first preferred	....	69	67
Appalachian Power of Bluefield, common	....	7	7
Appalachian Power of Bluefield, preferred	7	39	37
Cities Service of New York, common	6+extra	277	274
Cities Service of New York, preferred	6	87¼	89¼
Commonwealth Edison of Chicago	8	135	135
Comm. Power, Railway & Light of Jackson, common	4	57	58
Comm. Power, Railway & Light of Jackson, preferred	6	80	80
Federal Light & Traction of New York, common	....	14	14
Federal Light & Traction of New York, preferred	....	53	51
Illinois Northern Utilities of Dixon	6	82	82
Middle West Utilities of Chicago, common	2+2 extra	60	58½
Middle West Utilities of Chicago, preferred	6	79½	*78½
Northern States Power of Chicago, common	7	102	101
Northern States Power of Chicago, preferred	7	97½	98½
Pacific Gas & Electric of San Francisco, common	5	63½	64¼
Pacific Gas & Electric of San Francisco, preferred	6	92	92½
Public Service of Northern Illinois, Chicago, common	7	107½	107
Public Service of Northern Illinois, Chicago, preferred	6	99	99½
Republic Railway & Light of Youngstown, common	4	42	47
Republic Railway & Light of Youngstown, preferred	6	73	76
Standard Gas & Electric of Chicago, common	....	10½	12
Standard Gas & Electric of Chicago, preferred	6	37½	38
Tennessee Railway, Light & Power of Chattanooga, common	....	8½	8
Tennessee Railway, Light & Power of Chattanooga, preferred	6	41	37
United Light & Railways of Grand Rapids, common	4	46½	47
United Light & Railways of Grand Rapids, preferred	6	76	76¾
Western Power of San Francisco, common	....	16½	16
Western Power of San Francisco, preferred	6	66½	65
Western Union Telegraph of New York	5+extra	†94	94
Industrials—			
Electric Storage Battery of Philadelphia, common	4	62	62
General Electric of Schenectady	8	†161½	165
National Carbon of Cleveland, common	8	†300	†300
National Carbon of Cleveland, preferred	7	†130¼	†130¼
Westinghouse Electric & Mfg. of Pittsburgh, common	5+extra	†51½	50⅝
Westinghouse Electric & Mfg. of Pittsburgh, preferred	7	69	69

†Last Sale.
*Extra Dividend.

$4,500,000 preferred stock. Only one-half the par value of the common shares will be retained by present shareholders, and the rest will be utilized as part payment for properties acquired. With the proposed merger, capitalization would be $11,500,000 five-per-cent bonds, $7,000,000 six-per-cent cumulative preferred and $9,500,000 common. Directors declare that 75 per cent of earnings would be retail, against 36 per cent now, that earnings would immediately be more than doubled, and that the company would have a comprehensive distributing system.

The Indianapolis Light & Heat Company, Indianapolis, Ind., has filed a petition with the public service commission for authority to issue $400,000 in bonds. The company shows its bonded indebtedness is $3,628,000, with a capital stock of $2,375,000. The company spent $427,320.56 from Dec. 1, 1915, to Dec. 1, 1916, for improvements. Walter Marmon, secretary, and Charles C. Perry, president of the company, have signed the petition for the bond issue.

The Commonwealth Power, Railway & Light Company, Jackson, Mich., reports $16,962,606 gross earnings by its subsidiaries in 1916, a gain of $2,372,482 over the preceding year. Operating expenses absorbed $8,374,620, and the net income left available for dividends amounted to $2,651,742, an increase of $356,155. The year's surplus of $1,632,572 was $296,985 more than in 1915.

The Bay Point Light and Water Company and the Bay Point Utilities Company, San Francisco, Cal., have filed application supplementary to their request for authority for the light company to sell its properties to the utilities company.

Electrical Patents Issued February 13, 1917

Prepared by Thomas Howe, Patent Attorney, 2 Rector Street, New York, N. Y.

1,215,331. **Telephone Toll System.** H. M. Bascom, assignor to American Telephone & Telegraph Co., New York, N. Y. Tampering and proper operation of toll apparatus discriminated in control of signal at central.

1,215,348. **Telephone and Telegraph Relay or Repeater.** J. H. Cuntz, Hoboken, N. J. Core with primary and secondary coils, also has direct-current coil.

1,215,360. **Automatic Pressure Regulator for Electric Machines.** M. Fuss, Berlin, Germany. Vibrator contact, short circuits field resistance.

1,215,361. **Electrical Potential Regulator.** M. Fuss, Berlin, Germany. Modification of above.

1,215,365. **Cable-Armor.** H. R. Gilson, assignor to National Metal Molding Co., Pittsburgh, Pa. Formed of inner and outer helical strips.

1,215,366. **Armored Cable Connector.** H. R. Gilson, assignor to National Metal Molding Co. Structure of thimble for attachment to end of armor.

1,215,377. **Sanitary Telephone Mouthpiece.** E. M. Jenkins, Italy, Tex. Contains disinfectant with provision for disseminating fumes in the mouthpiece.

1,215,378. **Telephone Exchange System.** L. H. Johnson, assignor to Western Electric Co., New York, N. Y. Link circuits of manual system.

1,215,389. **Signal Gauntlet.** F. E. Lauray, Detroit, Mich. Battery, lamp and controlling contacts on glove.

1,215,393. **Trolley-Controlled Apparatus.** J. F. McElroy, assignor to Consolidated Car Heating Co. of West Virginia. Single track railway with cars controlled from a distance.

1,215,401. **Magnetic Reciprocator for Electric Generators.** E. R. O'Keefe, Omaha, Neb. End-play device.

1,215,421. **Block Signal System.** R. H. Souder and H. W. Souder, Tamaqua, Pa. Arrangement of spacer and through-block signals.

1,215,422 and 1,215,423. **Current Limiter.** C. H. Spangler, assignor of one-half to C. C. Long, Reading, Pa. Electromagnetic flicker devices.

1,215,427. **Electrical Heater.** L. M. Stocker, Lynn, Mass. For heating the stiffening pieces of boot and shoe uppers.

1,215,429. **Coil Structure for Electromagnetic Devices.** C. H. Thordarson, Chicago, Ill. Manner of insulating coil of bare ribbon.

1,215,430. **Insulated Terminal for Transformers and the Like.** C. H. Thordarson. Details of high-potential structure.

1,215,437. **Electric Circuit Controller.** T. Varney, assignor to Westinghouse Electric & Mfg. Co. Details of two-way enclosed switch for motor control.

1,215,453. **Starting Mechanism for Automobiles.** C. E. Wilson, assignor to Westinghouse Electric & Mfg. Co. Special gearing of starting motor.

1,215,485. **Thermostatic Fire Alarm.** C. J. Cid, Quebec, Canada. Structure of contact device.

1,215,487. **Telephone System.** H. P. Clausen, assignor to Western Electric Co., New York, N. Y. Arrangement for signaling extension from main instrument.

1,215,490. **Starting Mechanism for Automobiles.** F. Conrad and J. P. Nikonow, assignors to Westinghouse Electric & Mfg. Co. Details of variable ratio gearing.

1,215,491. **Fuse or Like Device.** N. J. Conrad, assignor to Schweitzer & Conrad, Chicago, Ill. Supports for removably mounting enclosed fuses.

1,215,492. **Switch.** E. E. Cook, Chicago, Ill. Details of special structure.

1,215,508. **Electromagnetic Device.** C. W. Dunham, assignor to Union Switch & Signal Co., Swissvale, Pa. Details of electromagnet with oscillating armature.

1,215,515. **Non-interference Successive Signal Box.** R. J. Gaskill, assignor to Gamewell Fire Alarm Telegraph Co., Newton Upper Falls, Mass. For fire alarms, telegraphs, etc.

1,215,522. **Railway Signaling.** H. W. Griffin, assignor to Union Switch & Signal Co., Swissvale, Pa. Block system.

1,215,524. **Safety Device for Elevators.** E. A. Hanff, assignor to Westinghouse Electric & Mfg. Co. Guards controlling motor circuit prevent jamming of persons or other objects between car and end of hoistway.

1,215,540. **Lightning Arrester.** R. P. Jackson, assignor to Westinghouse Electric & Mfg. Co. Horn gap arrangement.

1,215,549. **Electric Conductor Insulating Support.** J. A. Koontz, assignor of one-half to E. W. Beardsley, San Francisco, and R. W. Shoemaker, Alameda, Cal. Chain type suspension insulator.

1,215,562. **Hickey.** L. McCarthy, assignor to Macallen Co., Boston, Mass. Details of construction.

1,215,566. **Circuit Controller.** R. H. Manson, assignor to Stromberg Carlson Telephone Mfg. Co., Rochester, N. Y. Gang of push-button plunger switches.

1,215,568. **Starting Device for Automobiles.** C. B. Mills, assignor to Westinghouse Electric & Mfg. Co. Relates to motor gearing.

1,215,573. **Door Operating Device.** A. H. Otis, Cleveland, O. Electromagnetic control system for motor-operated sliding doors.

1,215,590. **Electric Switch.** H. G. Thompson, assignor to Safety Car Heating & Lighting Co. Electromagnetically operated.

1,215,592. **Electric Controller.** C. D. Vale, assignor of one-half to F. A. Young, Martinez, Cal. Arrangement of contacts on clock face controlled by hands.

1,215,595. **Self-Locking Junction Box Coupling.** A. W. Weikert and J. Pettibone, Washington, D. C. For coupling conduit to box.

1,215,604. **Automatic Printer.** G. M. Yorke, assignor to Western Union Telegraph Co., New York, N. Y. For printing telegraph receiver.

1,215,605. **Means for Synchronizing Rotary Devices.** G. M. Yorke and G. R. Benjamin, assignors to Western Union Telegraph Co. For synchronous telegraph system.

1,215,610. **Electric Heating Pad.** H. E. Bloomer, assignor to Sun-Ray Mfg. Co., Oshkosh, Wis. Arrangement of resistors and thermostatic members.

1,215,611. **Spark Plug.** D. L. Boggess, Liberty, Mo. Structural details.

1,215,635. **Sintering and Smelting Ore.** A. S. Dwight, New York, N. Y. Includes passing a current through the sinter cake.

1,215,639. **Starting and Stopping Mechanism for Engines.** A. D. Eberly, Spokane, Wash. Thermostatic switch for mounting on the exhaust pipe.

1,215,658. **Signaling System.** R. M. Hopkins, assignor to American District Telegraph Co., Jersey City, N. J. Arrangement of telegraph call box circuits.

1,215,670. **Automatic Railway Crossing Danger Signal.** J. B. Linker, Charlotte, N. C. Details of train-controlled circuits.

1,215,676. **Electric System for Vehicles.** R. H. Manson, assignor to Garford Mfg. Co., Elyria, O. Gearing and control of starting motor.

1,215,693. **Electric Soldering Iron.** H. A. Orme, Washington, D. C. Arrangement of heater and conductors in conjunction with a solder reel.

1,215,700. **Carbon Electrode and Method of Manufacturing Same.** R. D. Pike, San Francisco, Cal. Formed from lamp black derived from waste byproducts of manufacture of oil gas.

1,215,701. **Fuse Plug.** C. D. Platt, Bridgeport, Conn. Structural details.

1,215,702. **Loading Duplex or Multiplex Telephone Lines.** H. B. Pleikel and A. H. Olsson, Stockholm, Sweden. Duplicate double telephone lines worked on the Pupin system.

1,215,703. **Liquid Heater.** F. Poole, Jewell, Kans. For interposing in a pipe line and using electricity for heat.

1,215,704. **Automatic Electric Regulator with Stop Charge Relay.** H. H. Powell, assignor to U. S. Light & Heat Cor., Niagara Falls, N. Y. For variable speed generator in a car-lighting system.

1,215,722. **Circuit Protecting Device.** E. O. Schweitzer and N. J. Conrad, assignor to Schweitzer & Conrad, Chicago, Ill. Expulsion fuse.

1,215,734. **Telegraph Call.** C. Spiro, New York, N. Y. Arrangement of contacts, operating levers, etc.

1,215,742. **Gear Selecting Controller.** J. H. Stortz, assignor to Stortz Gear Shift Co., Wilmington, Del. Electromagnetic latches control gear shift of automobile.

1,215,748. **Electric Heater.** W. B. Underwood, assignor to Wilmot Castle Co., Rochester, N. Y. For inclusion in a pipe line.

1,215,757. **Flash Light.** W. L. White, Birmington, Ala. Structure of tubular, battery device.

1,215,770. **Moving Picture Machine.** G. D. Brady, Detroit, Mich. The lighting circuit is controlled by the tension of the film.

1,215,772. **Headlight.** F. Buchanan, Syracuse, N. Y. Mechanism of arc structure.

1,215,774. **Primary Battery.** E. F. Callander, assignor of one-half to L. B. Callender, Galesburg, Ill. Metal case covered with asphalt within and without, with an outer coating of pitch on the inferior and paraffin on the exterior.

1,215,786 and 1,215,787. **Means for Preventing Sparking in Direct Current Machines.** A. Fahrmbacher, assignor to Siemens Schuckert Werke, G. M. B. H., Berlin, Germany. Compensated machines.

1,215,795. **Elevator Signal.** R. H. Gaylord, assignor to R. H. Gaylord Co., Los Angeles, Cal. Telephonic communication with car is established as it approaches a signaled landing.

1,215,800. **Combination Electric Lock Switch.** R. O. Hammond, assignor to Hammond Safety Auto Lock Co., Paterson, N. J. Detailed contact arrangement.

1,215,807. **Electric Switch.** E. S. Huff, assignor to Simms Magneto Co., East Orange, N. J. Lever operated.

1,215,813. **Combination Piano and Organ Player Mechanism.** R. S. Irvine, San Francisco, Cal. Organ is electrically played simultaneously with piano.

1,215,814. **Switch for Automatic Telephone Systems.** W. Kaisling, assignor to Kellogg Switchboard & Supply Co., Chicago, Ill. Structure of selective switch.

1,215,815. **Electric Signaling System.** P. Kaminski, and O. Schneider, assignors to Siemens & Halske, A. G. Berlin, Germany. A common receiver combined with a plurality of senders indicates, if a sending element is in a wrong position and sender is rendered ineffective.

1,215,820. **Frequency Conversion System for Electrical Oscillations.** T. Kujirai, Hongo, Tokyo, Japan. Transformer arrangement.

1,215,836. **Spark Plug.** A. J. Mummert, assignor to McQuay Norris, Mfg. Co., St. Louis, Mo. Structural details.

1,215,838. **Lighting Fixture.** H. V. S. Negus, Boundbrook, Borough, N. J. Ceiling structure for indirect lighting.

1,215,845. **Automobile Signal.** J. K. Payne, Santa Barbara, Cal. Direction indicator.

1,215,847. **Regenerative Electric Motor System and Controller Therefor.** D. W. Perin, Newton, Mass. Manner of controlling field coils and armature and field resistances.

1,215,852. **Electromechanical Telautograph.** J. B. Rawlings, Memphis, Tenn. Comprises duplicate machines, each adapted to serve as a transmitter or receiver, moving in unison.

1,215,855. **Contact Shoe for Third Rail Electric Cars.** C. F. Raydure, West Philadelphia, Pa. Structural details.

1,215,856. **Apparatus for Electroplating Tubes.** N. H. Raymond, assignor to Clifton Mfg. Co., Jamaica Plain, Mass. Relates to gearing for supporting and turning the tubes.

1,215,857. Process of Producing Metallic Alloys. M. A. Rebert, York, Pa. Ferronickel alloy is produced by melting calcium fluorid and a nickeliferous ore containing iron and freeing the fluorin by subjection to an electric current.

1,215,859. Switch Mechanism. J. N. Reynolds, assignor to Western Electric Co., New York, N. Y. Electromagnetically operated connecting switch for telephone trunks and lines.

1,215,860. Telephone Switch Mechanism. J. N. Reynolds, assignor to Western Electric Co. Modification of above.

1,215,867. Ohmeter. B. P. Romain, assignor to Weston Electrical Instrument Co., Newark, N. J. Rotary, spring-restrained member in field of magnet has two windings, one in series with known resistance and other in series with unknown resistance.

1,215,883. Crosstree for Telegraph Poles. J. S. Simpson, Ingomar, Miss. Insulators are protected from breakage.

1,215,894. Incandescent Electric Lamp. S. Yuyama, Brooklyn, N. Y. Form and support of filament.

1,215,897. Insulated Rail Joint. C. E. Ballou, assignor to Ballou Safety Rail Joint & Nut Co., Roanoke, Va. Details of construction.

1,215,901. Direction Indicator. L. M. Bowman, assignor of one-half to W. A. Smith, Bartlesville, Okla. Has solenoid controlled indicating arrow.

1,215,907. Paste for Storage Battery Plates. C. C. Carpenter, assignor to U. S. Light & Heat Co., Niagara Falls, N. Y. A heavy oxide of lead is mixed with a lighter oxide to facilitate penetrating of electrolyte.

1,215,910. Vulcanizing Apparatus. M. H. Clark, assignor to Boston Rubber Shoe Co., Boston, Mass. Circulation of vulcanizing medium in a receptacle is electrically controlled by a thermostat.

1,215,911. Call Distributing System. H. P. Clausen, assignor to Western Electric Co., New York, N. Y. For telephone systems.

1,215,913 and 1,215,914. Welding Controller. L. P. Coulter, assignor to Cutler Hammer Mfg. Co., Milwaukee, Wis. Arrangement of electromagnetic switches for controlling resistance.

1,215,917. Selecting Mechanism. O. A. Danielson, assignor to Western Electric Co. Impulse-operated switch mechanism.

1,215,918. Selecting Apparatus and System. A. F. Dixon, assignor to Western Electric Co. Modification of above.

1,215,921. Welding Controller. C. T. Evans, assignor to Cutler Hammer Mfg. Co. Modification of 1,215,913 and 1,215,914.

1,215,925. Telephone Exchange System. C. L. Goodrum, assignor to Western Electric Co. Automatic.

1,215,933. Rail Bond. F. O. Hartman, assignor to Hartman Electrical Mfg. Co., Mansfield, O. Adapted for welding to rail by oxy-acetylene process.

1,215,964. Electric Welding Machine. T. E. Murray, New York. Resistance type machine has magnet on movable electrode to hold work.

1,215,965. Method of Flanging the End of a Metal Tube. T. E. Murray, New York. N. Y. Flange is electrically welded to tube.

1,215,966. Means for Electrically Welding Tubes in Sleeves. T. E. Murray. Tube end is electrically butt welded to a ring within the sleeve.

1,215,967. Electrically Welded Tube and Flange Plate. T. E. Murray. Modification of 1,215,965.

1,215,968. Method of Making Sheet Metal Wheels. T. E. Murray. Hub and spoke sections are electrically welded together and to each other.

1,215,969. Sheet Metal Piston. T. E. Murray. Semi-cylindrical sections are electrically welded together and head welded to end.

1,215,979. Signal. G. J. Pauly, Frackville, Pa. A winding drum has an opening therein having a door carrying a signal.

1,215,986. Combination Flower Pot and Reflector. A. E. Pohlman, Watertown, Wis. Suspended structure having upwardly disposed reflector surrounded by flower pot and a glass bowl beneath.

1,215,999. Fuse Device. E. O. Schweitzer, Chicago, Ill. Indestructible casing has fuse lining its interior wall and containing a filler.

1,216,000. Electrical Insulator. T. Scully, New York, N. Y. Strain insulator adapted to receive two interlocking conductors at right angles to each other.

1,216,002. Electric Motor. C. A. Shea, Boston, Mass. Manner of controlling motor having field core of high retentiveness and a connected armature winding.

1,216,016. Electric Display Device. C. Tregoning, New York, N. Y. Manner of operating a pair of wheels carrying lamps.

1,216,020. Semaphore Signal Device. R. P. Tuttle, New York, N. Y. Structure of spectacle and blade.

1,216,025. Direction Indicator for Automobiles. J. E. Warman, Riverside, Cal. Solenoid operated arrow.

1,216,038. Railway Traffic Control Apparatus. B. F. Wooding, assignor to Wooding Railway Warning Device Co., Denver, Colo. Air brake is controlled by track instruments.

1,216,057. Electrical Coupling Device for Railway and Other Vehicles. L. Boirault, Paris, France. Comprises hand and automatic connections.

1,216,074. Protector for Electric-Light

1,215,365. Cable Armor.

Globes. H. H. Choteau, assignor of one-fourth to F. R. Wilson, one-fourth to L. Wilson and one-fourth to O. Smith, all of Topeka, Kan. An arrangement of metal bands around the globe.

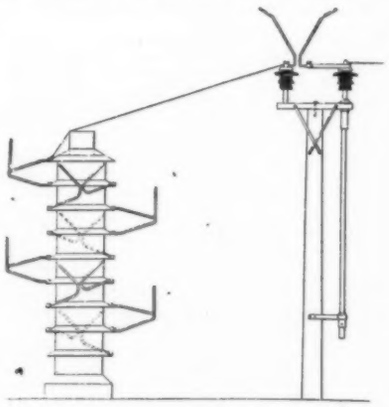
1,216,083. Electric Regulation. J. L. Creveling, assignor to Safety Car Heating & Lighting Company, New York. N. Y. For car lighting systems.

1,216,092. Spark Plug. H. A. Dortch, Des Moines, Iowa. Structural details.

1,216,100. Headlight Dimmer. L. A. Feuchter, Ironton, O. Structure and operation of shield.

1,216,101. Electric House Heating Furnace. A. C. Fingerle, Modesto, Cal. Arrangement of air chambers and heating coils.

1,216,111. Switch Mechanism for Tele-



1,215,540. Lightning Arrester.

phone Systems. L. J. Gorsuch, East Pleasant Plains, Iowa. Arrangement of receiver hook operated contacts.

1,216,124. Self Contained High Tension Battery Ignition Unit System. F. R. Hoyt, East Orange, N. J., assignor to Simms Magneto Co. For use when a battery constitutes the sole source.

1,216,125. Self Contained High Tension Battery Ignition Unit. F. R. Hoyt, assignor to Simms Magneto Co. Related to above.

1,216,126. Motor Control System. W. P. Jackson, assignor to General Electric Co., Schenectady, N. Y. For a number of series motors.

1,216,136. Transmission Circuit. B. W. Kendall, assignor to Western Electric Co. Telephone operating system.

1,216,139. Spark Plug for Internal Combustion Engines. M. G. Kopf, assignor to McCormick Mfg. Co., Dayton, Ohio. Structural details.

1,216.151. Interrupter Mechanism for Ignition Dynamos. C. T. Mason, assignor to Splitdorf Electrical Co., Newark, N. J. Method of controlling discharges at high frequency in a current generating coil.

1,216,153. Telephone Carrier. J. A. McKnight, Jeffersonville, Ind. Vehicle for transporting telephone sets.

1,216,170. Lightning Rod Connector. W. F. Russell Bourbon, Ind. Formed from a single strip of metal.

1,216,183. Electrotherapeutic Rejuvenator. C. M. Swingle, Cleveland, O. Tubular shell has medicament on outside and heating coil within.

1,216,211. Art of Discharging Sheets from a Printing Press Substantially Free from Electricity. M. Clinton, assignor of one-fourth to Penn Printing House, one-fourth to Harry Miller, Delaware Co., and one-fourth to W. E. Dunningham, Philadelphia, Pa. Sheets are passed in contact with a heated grounded conductor.

1,216,231. Signaling System. R. J. Hewett, Westfield, N. J. Railway block system; three-position, normal danger.

1,216,235. Scavenging Pump for Internal Combustion Engines. B. Kramer, assignor to General Electric Co. For multi-cylinder, high compression engine; driving motor supplied from generator driven by engine.

1,216,236. Regulator. H. A. Laycock, assignor to General Electric Co. For controlling interchange of energy between direct and alternating systems.

1,216,237. Controlling Means for Engine Generator Driven Vehicles. H. Lemp, assignor to General Electric Co. Controls by varying motor conections and constant speed setting of engine.

1,216,238. Switching Mechanism. F. B. Little, assignor to J. C. Deagan Musical Bells, Chicago, Ill. Arrangement of contacts and conductor conduit in special structure.

1,216,242. Electric Motor. W. R. MacDonald, London, England. Incased motor has compressed air in casing at starting and water is admitted to contact with windings during running.

PATENTS EXPIRED.

The following United States electrical patents expired on February 20, 1917:

643,618. Firing Apparatus. E. B. Babbitt, U. S. Army.

643,649. Apparatus for Controlling Electric Motors. J. J. Heilmann, Paris, France.

643,666. Signal System for Railways. K. W. Mansfield and W. R. Thompson, South Norwalk, Conn.

643,706. Telegraphic Safety Device. S. R. Wright, Morton, N. Y.

643,709. Electric Suburban Car. M. Brillinger, Toronto, Can.

643,722. Thermostat. C. E. May, Dunedin, New Zealand.

643,730. Electric Switch. W. T. Pringle, Primos, Pa.

643,742. Conduit System for Electric Railways. Leon Dion, Boston, Mass.

643,744. Electric Heater. G. C. Hawkins, Boston, Mass.

643,749. Telephone Directory. L. H. Mertz, Los Angeles, Cal.

643,758. Starting Box and Controller for Electric Motors. F. R. Blake, Boston, Mass.

643,810. Contrivance for Avoiding Collisions of Trains. C. Burian, Bucharest, Austria-Hungary.

643,814. Lighting Apparatus. R. M. Dixon, East Orange, N. J.

643,823. Motor-Actuated Signal Mechanism. T. B. Keeler, Rahway, N. J.

643,824. Motor-Actuated Signal. T. B. Keeler, Rahway, N. J.

643,830. Telephone Transmitter. A. Stromberg, Chicago, Ill.

643,834. Electric Arc Lamp. C. T. Toerring, Philadelphia, Pa.

643,840. Combined Electrical and Tubular Organ Action. W. B. Fleming, Detroit, Mich.

643,854. Electric-Motor Wheel. J. T. Whittlesey, Elizabeth, N. J.

643,864. Automatic Return-Signaling Device for Telephones. F. Burger, Fort Wayne, Ind.

643,865. Controller for Electric Automobiles. C. G. Burrows. Windsor, Conn.

643,872. Illuminated Sign. C. H. Hill, Williamsport, Pa.

643,880. Thermostatic Apparatus. L. Morgenstern, Gottingen, Germany.

643,905. Valve-Operating Mechanism. A. N. Locke, Salem, Mass.

643,993. Telephone Transmitter. C. E. Tucker and L. S. Jenkins, York, Pa.

644,029. Process of Electro-Deposition of Metals. S. O. Cowper-Coles, London, England.

Design.

32,259. Casing for Dynamo-Electric Machines or Electric Motors. N. C. Bassett, Lynn, Mass.